NAVAIR 16-30DRW29-1

Handbook

Operation, Service, and Overhaul Instructions With Illustrated-Parts Breakdown

RADIO RECEIVING SET AN/DRW-29

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INTRODUCTION

This handbook provides the operation, service, and overhaul instructions, and illustrated parts breakdown for the Radio Receiving Set AN/DRW-29. These instructions are designed to enable organizational and field maintenance personnel to understand the operation and maintenance of the receiving set. It is assumed that all personnel using this handbook have had previous maintenance experience on similar types of equipment.

Electrical and electronic symbols and reference designations used in this handbook are in accordance with MIL-STD-15A and MIL-STD-16B. Abbreviations are in accordance with ANA Bulletin No. 261A.

SECTION I

DESCRIPTION AND LEADING PARTICULARS

T 2580

Figure 1-1. Radio Receiving Set AN/DRW-29.

1-1. GENERAL.

1-2. This publication comprises operation, service, and overhaul instructions with illustrated parts breakdown for the Radio Receiving Set AN/DRW-29, Model BCR-50A (contractor's designation) and Contract Nos. NOw(A)62-0619-r and NOw(A)63-0656-f.

1-3. PURPOSE OF EQUIPMENT.

1-4. The Radio Receiving Set AN/DRW-29 (hereinafter called the receiving set) is intended for installation in pilotless aircraft wherein the output functions of the receiving set can be utilized to control various functions of the aircraft. The receiving set is capable of receiving and demodulating a uhf, FM-coded, radio control signal in the frequency range of 406 to 550 megacycles, and having maximum modulation deviation of either ±120 or ±300 kilocycles (selectable). The receiving set can demodulate, or decode, a signal that is frequency-modulated, or coded, by as many as six of a possible 20 preselected, specified audio-frequency modulating signals simultaneously. Each of the 20 audio-frequency modulating signals represent specific control commands which appear as relay closures at the output of the receiving set.

1-5. LEADING PARTICULARS.

1-6. The receiving set is shown in figure 1-1. Table 1-1 lists the components of the receiving set by descriptive titles, formal nomenclature, and contractor's designation. The descriptive title will be used throughout this handbook to refer to separate components. Leading particulars for the receiving set are shown in table 1-2 through 1-6.

1-7. PHYSICAL DESCRIPTION.

1-8. The physical makeup of the receiving set is shown graphically in figure 1-2. The receiving set comprises the radio receiver and a mounting base. The radio receiver is made up of a front panel assembly, which contains all of the output relays, a receiving unit assembly, an ancillary circuit board, and five decoder circuit boards. The receiving unit assembly includes an r-f oscillator circuit board and an i-f/video amplifier circuit board in addition to the individual parts that make up the r-f amplifier and mixer circuits (receiving unit subassembly). The ancillary circuit board, mounted on the radio receiver main chassis, contains the carrier detector amplifier and

the audio output amplifier. Twenty audio decoders are mounted on the five decoder circuit boards which are plug-in units on the main chassis.

1-9. The various assemblies which make up the receiving set are identified and illustrated in section XI.

1-10. Sections I through XIII of this handbook apply to Radio Receiving Set, AN/DRW-29, Model BCR-50A (contractor's designation) and Contract Nos. NOw(A) 62-0619-r and NOw(A)63-0656-f. Additional models will be covered in section XIV by the use of Difference Data Sheets.

TABLE 1-1. EQUIPMENT NOMENCLATURE

Descriptive Title	Formal Nomenclature	Contractor's Designation	Contractor's Part Number
Receiving Set	Receiving Set, Radio, AN/DRW-29	BCR-50A	111894
Mounting Base	Base, Mounting MT-2740/DRW-29	Base, Mounting MT-(*)/DRW	21928
Radio Receiver	Receiver, Radio, R-1136/DRW-29	Receiver, Radio R-1136/DRW	112000

TABLE 1-2. PHYSICAL CHARACTERISTICS OF EQUIPMENT

Item	Dimensions in Inches			Weight In Lbs.
	Height	Width	Depth	
Receiving Set	7-1/2, Max.	6-29/32	9-3/16, Max.	10
Mounting Base	2-3/16 ±1/32	6-1/2 ±1/32	9-3/16, Max.	1
Radio Receiver	5-3/4, Max.	6-29/32	8-7/16, Max.	9

TABLE 1-3. ELECTRICAL CHARACTERISTICS OF RADIO RECEIVER

Characteristic	Description
Input Power	Voltage - 27.5 ±0.5 volts dc
	Power Consumption - 7.5 watts nominal, 8.25 watts maximum
R-f Section	Sensitivity - 10 microvolts to 2 volts under normal conditions. 40 microvolts to 2 volts under extreme environmental conditions.
	Frequency Range - 406 to 550 megacycles, by means of plug-in crystals (see table 1-5).
	Frequency Stability - ±0.01 percent
	Antenna Input Impedance - 52 ohms, nominal
	Maximum allowable FM deviation of carrier - 300 kc
I-f Section	Intermediate Frequency - 33.5 megacycles
Output Section	Type of Output - Relay closures, which make or break connections to external control mechanisms.
	Audio Decoder Frequencies - 7.5 to 73.95 kc (see table 1-4).
	Total Number of Outputs Available - 20 spdt-type relay closures (channels 1-20) plus 10 spst-type relay closures (channels 1-5 and 11-15) controlled by audio-frequency coding (modulation) of received signal.

TABLE 1-4. DECODER CHANNEL FREQUENCIES

Channel	Frequency in Cps	Channel	Frequency in Cps
1	7,500	11	25,010
2	8,460	12	28,210
3	9,540	13	31,830
4	10,760	14	35,900
5	12,140	15	40,490
6	13,700	16	45,680
7	15,450	17	51,520
8	17,430	18	58,120
9	19,660	19	65,560
10	22,170	20	73,950

TABLE 1-5. LOCAL OSCILLATOR CRYSTAL FREQUENCY VERSUS OPERATING FREQUENCY OF RECEIVING SET*

Crystal Frequency	Operating Frequency		Crystal Frequency	Operating Frequency	
	Hi	Low		Hi	Low
48.83333	406	473	51.61111	431	498
48.94444	407	474	51.72222	432	499
49.05555	408	475	51.83333	433	500
49.16666	409	476	51.94444	434	501
49.27777	410	477	52.05555	435	502
49.38888	411	478	52.16666	436	503
49.50000	412	479	52.27777	437	504
49.61111	413	480	52.38888	438	505
49.72222	414	481	52.50000	439	506
49.83333	415	482	52.61111	440	507
49.94444	416	483	52.72222	441	508
50.05555	417	484	52.83333	442	509
50.16666	418	485	52.94444	443	510
50.27777	419	486	53.05555	444	511
50.38888	420	487	53.16666	445	512
50.50000	421	488	53.27777	446	513
50.61111	422	489	53.38888	447	514
50.72222	423	490	53.50000	448	515
50.83333	424	491	53.61111	449	516
50.94444	425	492	53.72222	450	517
51.05555	426	493	53.83333	451	518
51.16666	427	494	53.94444	452	519
51.27777	428	495	54.05555	453	520
51.38888	429	496	54.16666	454	521
51.50000	430	497	54.27777	455	522

* All frequencies in megacycles. Each crystal can be used for operation of the receiving set at either of the two frequencies shown.

TABLE 1-5. LOCAL OSCILLATOR CRYSTAL FREQUENCY VERSUS OPERATING FREQUENCY OF RECEIVING SET* - CONTINUED

Crystal Frequency	Operating Frequency		Crystal Frequency	Operating Frequency	
	Hi	Low		Hi	Low
54.38888	456	523	55.94444	470	537
54.50000	457	524	56.05555	471	538
54.61111	458	525	56.16666	472	539
54.72222	459	526	56.27777	473	540
54.83333	460	527	56.38888	474	541
54.94444	461	528	56.50000	475	542
55.05555	462	529	56.61111	476	543
55.16666	463	530	56.72222	477	544
55.27777	464	531	56.83333	478	545
55.38888	465	532	56.94444	479	546
55.50000	466	533	57.05555	480	547
55.61111	467	534	57.16666	481	548
55.72222	468	535	57.27777	482	549
55.83333	469	536	57.38888	483	550

* All frequencies in megacycles. Each crystal can be used for operation of the receiving set at either of the two frequencies shown.

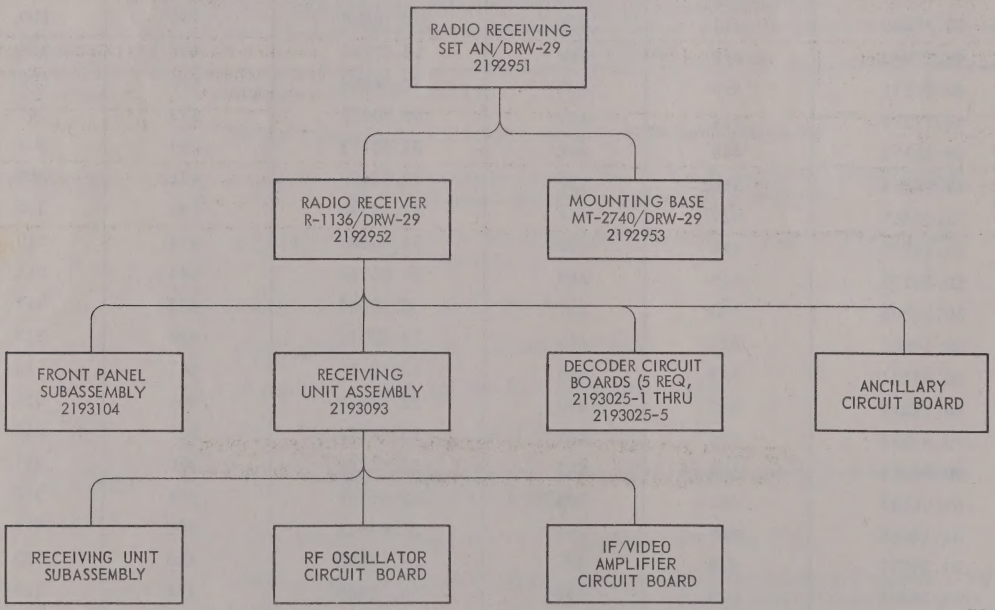

RADIO RECEIVING SET AN/DRW-29 2192951
RADIO RECEIVER R-1136/DRW-29 2192952
MOUNTING BASE MT-2740/DRW-29 2192953
FRONT PANEL SUBASSEMBLY 2193104
RECEIVING UNIT ASSEMBLY 2193093
DECODER CIRCUIT BOARDS (5 REQ, 2193025-1 THRU 2193025-5
ANCILLARY CIRCUIT BOARD
RECEIVING UNIT SUBASSEMBLY
RF OSCILLATOR CIRCUIT BOARD
IF/VIDEO AMPLIFIER CIRCUIT BOARD
T2481

Figure 1-2. Receiving Set Physical Makeup.

SECTION II

TEST EQUIPMENT AND SPECIAL TOOLS

2-1. TEST EQUIPMENT.

2-2. Table 2-1 lists required test equipment by nomenclature, part number, and application. Only specified equipment or their equivalents should be used to perform the tests outlined in this handbook.

2-3. SPECIAL TOOLS.

2-4. A special alignment tool, figure 2-1, is required for alignment of the receiving unit assembly in the radio receiver. The alignment tool is located under the top cover of the receiving unit assembly. No other special tools are required.

2-5. The slotted end of the alignment tool is used for aligning the oscillator and tripler tuning screws of the receiving unit assembly. The specially shaped opposite end is used for aligning the r-f tuning, r-f amplifier, and harmonic selector capacitors.

TABLE 2-1. TEST EQUIPMENT

Name	Type	Alternate	Use
Signal Generator	AN/DRM-20		Provide r-f signal to test and align receiving set.
R-f Attenuator, Fixed, 20 db	Model HFA-50 (Applied Research, Inc.)		Attenuate r-f input test signal during carrier relay adjustment.
Multimeter	AN/PSM-4	Model 260 (Simpson)	Voltage and resistance measurements.
Ac VTVM 0.001v to 300v	ME-6D/U	HP-400H (Hewlett-Packard)	Monitor a-c voltages during test and adjustments.
Audio Coder, IRIG Channels 1-20	BCC-6E (Babcock)		Generate subcarrier frequencies during test and adjustments.
Radio Test Set	AN/DRM-19		Provides receiving set primary power and provides for monitoring various test functions.
Resistor	560 ohm, 1 watt ±20%		Dummy load for video amplifier.
Dc VTVM	HP-410B (Hewlett-Packard)		Monitor d-c voltages during test and adjustments.

Figure 2-1. Alignment Tool, P/N 2192996.

SECTION III

PREPARATION FOR USE AND RESHIPMENT

3-1. GENERAL.

3-2. Upon receipt of the receiving set, it should be unpacked, given an initial inspection, installed, and subjected to an initial checkout as outlined in this section. Defects noted during the initial inspection or the initial checkout should be corrected in accordance with instructions contained in sections VI and VII.

3-3. UNPACKING INSTRUCTIONS.

3-4. During unpacking of the receiving set, care should be exercised to avoid damaging the equipment. Observe all unpacking instructions on the shipping container. Remove all miscellaneous packing material and desiccants. The packing material should be checked carefully for small items and mounting hardware.

3-5. The receiving set is shipped completely assembled in a single container. The method of unpacking the receiving set is obvious and does not warrant detailed instructions.

3-6. INITIAL INSPECTION AND CHECKOUT.

3-7. The receiving set was thoroughly checked and inspected by the manufacturer prior to shipment and should function properly; however, the equipment must be given a preliminary inspection, before installation, to isolate any damage that may have occurred during shipment.

3-8. Make the initial inspection as follows:

CAUTION

DO NOT tamper with any maintenance adjustments during inspection; these adjustments were set at the factory for correct operation.

1. Inspect the general appearance of the case and assemblies for dirt, dents, corrosion, scratched paint, illegible markings, and other signs of rough handling.

2. Check the mounting base for mechanical defects.

3. Perform the minimum performance standards test of table 6-1.

3-9. INSTALLATION INSTRUCTIONS.

3-10. The receiving set can be mounted on any level surface. Allow a minimum sway clearance of 11/16 inch at the rear, 3/4 inch on each side, and 10 inches in front for removal of the main chassis from the case. See figure 3-1 for mounting dimensions.

3-11. The receiving set requires a 27.5 ±0.5 volts dc power supply with a minimum capacity of 300 milliamperes. The input power is connected to the receiving set at J2, pin L (+) and pin J (ground). J2 also has relay output functions on some of its pins. Connector J3 provides all other relay output functions. The antenna cable is connected to the ANT. INPUT connector J1. See figure 1-1.

3-12. PREPARATION FOR RESHIPMENT.

3-13. The receiving set should be packed for reshipment in accordance with specification MIL-E-17555E, with preservation to level "A" and packing to level "C".

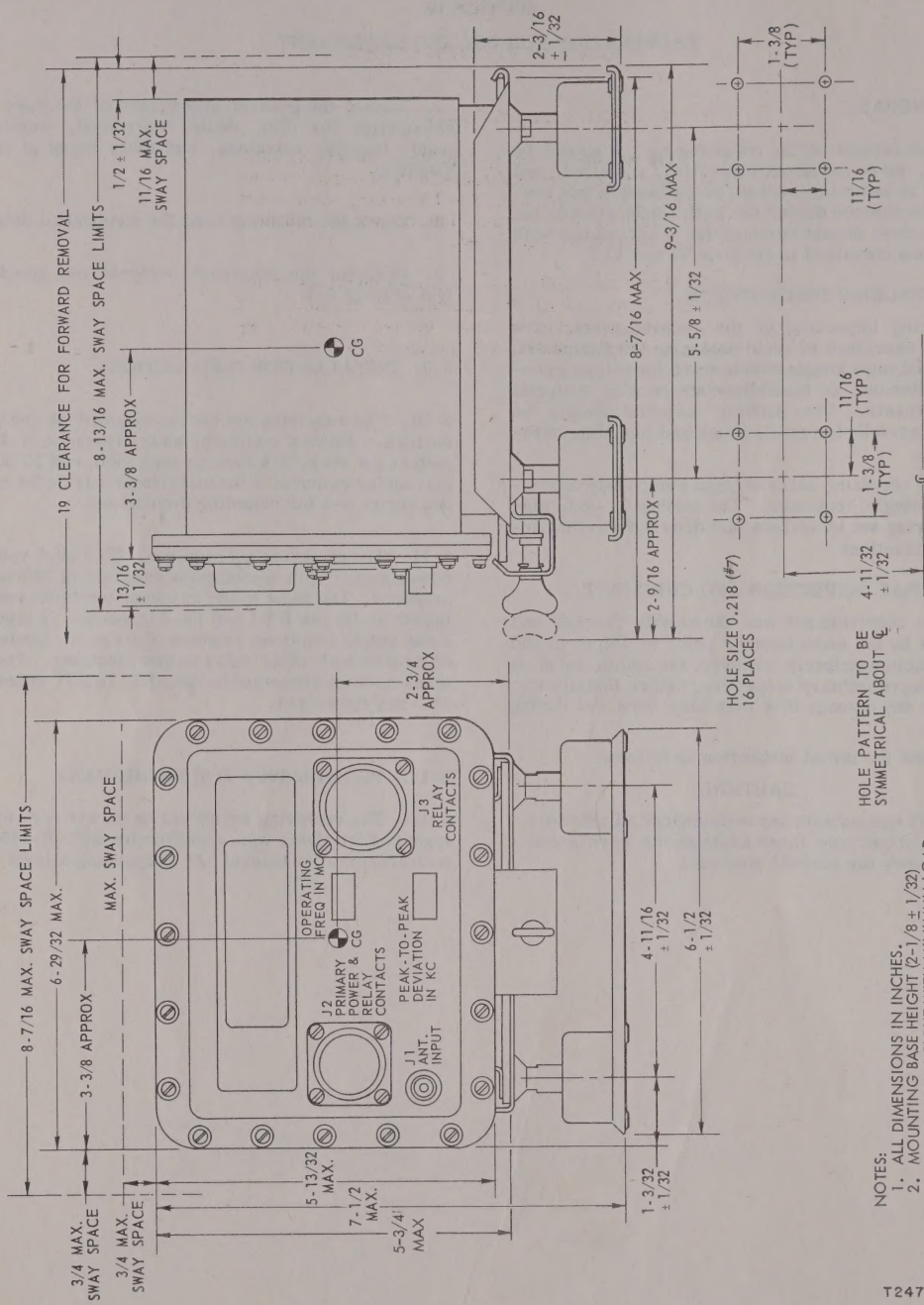


Figure 3-1. Radio Receiver Outline Dimensional Diagram.

SECTION IV

OPERATING INSTRUCTIONS

4-1. GENERAL INFORMATION.

4-2. The receiving set is capable of receiving uhf, FM-coded radio control signals in the frequency range of 406 to 550 megacycles. The FM coding signals are translated into relay contact closures which constitute the output of the receiving set.

4-3. After the receiving set has been installed as described in section III, its operation is automatic. If it becomes necessary to change the r-f operating frequency, refer to section VII, paragraph 7-4.

SECTION V

THEORY OF OPERATION

5-1. This section presents the theory of operation of the radio receiver. The mounting base, which provides shock isolation for the radio receiver, is not discussed due to its mechanical simplicity.

5-3. GENERAL FUNCTIONAL DESCRIPTION.

5-4. The radio receiver is capable of receiving a frequency-modulated signal in the frequency range of 406 to 550 megacycles. The received signal may be frequency-modulated by as many as six separate fixed-frequency audio signals, simultaneously. The radio receiver detects these audio-frequency modulations of the received signal, separates the individual audio frequencies (if more than one is present) and provides outputs in the form of relay closures to indicate the presence of any combination (up to six at any one time) of 20 preselected audio frequencies (table 1-4). The output relay closures can be used to control functions external to the radio receiver.

5-5. As shown in the simplified block diagram, figure 5-1, the received r-f signal is applied to the r-f circuits where it is amplified and converted to an i-f frequency (33.5 mc). The signal is then amplified in the i-f amplifier. The i-f output is applied to an FM ratio detector which extracts the modulation. A second output from the i-f amplifier is applied to the carrier detector circuit, which is described in paragraph 5-7.

5-6. The output of the FM ratio detector may be a single audio frequency or a composite of several (maximum of six simultaneous) audio frequencies, which are used to frequency-modulate the carrier at the transmitting source. The composite audio signal from the ratio detector is amplified in the video amplifier and the audio output amplifier. The composite audio signal is then applied through a set of contacts of the carrier relay to all 20 audio decoders. Each decoder is tuned to a specific audio frequency in the range from 7.5 to 73.95 kc, and each will energize its corresponding relay whenever its specific audio frequency is present in the composite audio signal.

5-7. The second output from the i-f amplifier is used by the carrier detector circuit to produce a d-c output voltage, the magnitude of which is proportional to received signal strength. When the received r-f signal at the input of the radio receiver is 10 microvolts or more, the carrier detector circuit energizes the carrier relay, which passes the composite audio from the audio output amplifier to the audio decoders. If the r-f signal level drops below 5 microvolts, the carrier relay is deenergized, the audio amplifier output circuit is opened, and all decoder input circuits

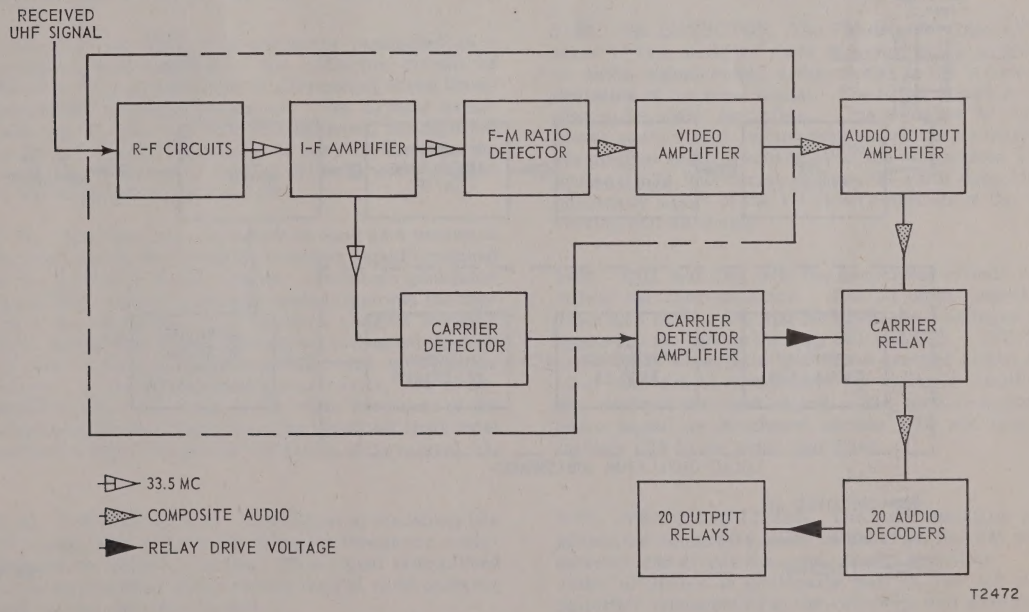


Figure 5-1. Radio Receiver Block Diagram.

grounded. The carrier relay also provides externally connected single-pole double-throw switching through another set of contacts.

5-8. Primary volts power for the radio receiver volts obtained from a 27.5 volts d-c external source. The 27.5 volts dc is used directly as a supply voltage for some circuits. Several voltage supply circuits are used to obtain lower d-c operating voltages from the 27.5 volts d-c primary supply.

5-9. CIRCUIT DESCRIPTIONS.

5-10. The paragraphs that follow describe the circuits of the major functional blocks shown in figures 5-1 and 5-2. In addition to the simplified diagrams given in this section, refer to the schematic diagram of the radio receiver, figure 9-1, sheets 1, 2, and 3.

5-11. R-F CIRCUITS. The r-f circuits include the tuned input circuits, r-f amplifier, local oscillator and mixer. (See figure 5-2.) These circuits are all physically located in the receiving unit assembly.

5-12. The r-f signal is applied to the radio receiver at ANT. INPUT connector J1 and is fed directly through three input tuned-line cavities to the r-f amplifier. The r-f amplifier output is applied to the mixer where the signal is heterodyned with the local oscillator signal. The basic local oscillator signal is generated by a crystal-controlled oscillator and is fed through a frequency tripler and harmonic generator to produce the required local oscillator frequency which is selected by the harmonic selector. The oscillator, tripler, and harmonic generator are physically located in the local oscillator subassembly in the receiving unit assembly. The harmonic selector is physically located in the r-f subassembly.

5-13. Input Circuits. As shown in figure 9-1, sheet 1, the r-f tuning section consists of three tuned-line cavity circuits having resonant frequencies tunable over the r-f operating frequency range of the equipment, 406 to 550 megacycles. The receiving unit is tuned to a specific operating frequency by adjusting C1, C2, and C3. In each cavity, the signal lead is connected to the cavity wall by a stub that will present a nominal 50-ohm impedance at the signal frequencies. The LC circuit in each cavity tunes the cavity to the signal frequency.

5-14. R-f Amplifier. The r-f amplifier (figure 9-1, sheet 1) consists of Q1 and its associated circuit. The output of the r-f amplifier is tuned by means of C4, L4, and the corresponding cavity. Q1 is a PNP type transistor connected in the configuration of a grounded-base r-f amplifier. The input signal is applied through C6 to the emitter, and the base is clamped at +9.7 volts dc. The signal from the collector of Q1 is developed across the tuned plate load circuit composed of the cavity, C4, and L4. This signal is coupled through C9 to the emitter of mixer stage Q2. The r-f amplifier stage provides amplification of the r-f input signal and also serves to isolate the radio receiver input from the mixer stage.

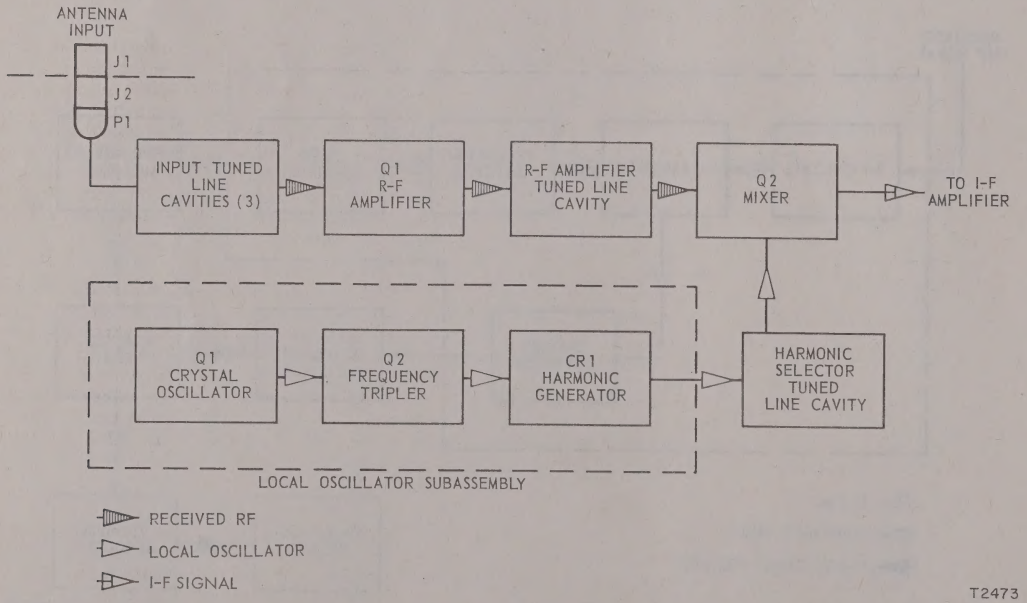


Figure 5-2. R-f Circuits Block Diagram.

5-15. Mixer. The mixer circuit (figure 9-1, sheet 1) heterodynes the r-f signal from the r-f amplifier with the local oscillator signal to produce the required intermediate frequency of 33.5 megacycles. The mixer, Q2, is a PNP type transistor. The r-f input signal is applied through C9 to the emitter, while the local oscillator signal which is 33.5 mc removed from the r-f input signal, is coupled to the base of Q2. The output circuit of Q2 is tuned to the i-f frequency, 33.5 megacycles. The i-f signal is applied through C24 to the i-f amplifier input. The local oscillator signal applied to the base of Q2 is developed across L5 and R14 in the harmonic selector tuned-line cavity. The cavity functions as part of the local oscillator circuit (final frequency tripler) and will be more fully discussed in the local oscillator circuit description, paragraph 5-16, and a harmonic selector which is physically located in the r-f subassembly.

5-16. Local Oscillator. The local oscillator (figure 9-1, sheet 1) consists of a crystal-controlled oscillator, a frequency tripler, a harmonic generator, and a harmonic selector which is physically located in the r-f subassembly. If a 48.83333-megacycle oscillator crystal is selected, its frequency is multipled by a factor of three in the tripler stage to 146.5 megacycles, which is again multipled by a factor of three by the harmonic generator to 439.5 megacycles, the frequency to which the harmonic selector is tuned.

5-17. Q1 is a PNP type transistor used as a crystal-controlled local oscillator. The crystal oscillator frequency is determined by the crystal, Y1, in the feedback loop. The output signal is developed across the local oscillator tank circuit composed of C4, C5, and L2. L2 is the crystal oscillator adjustment coil. The crystal oscillator output signal is coupled through C6 to the emitter of Q2, the tripler stage.

5-18. Q2 is a PNP type transistor connected as a grounded base amplifier, the collector circuit of which is tuned (L3 and C8) to a frequency three times the crystal oscillator frequency. The crystal oscillator signal, which is rich in harmonics, is amplified by Q2 and the third harmonic is developed across the tuned output circuit. This signal is directly coupled to the harmonic generator, CR1.

5-19. The harmonic generator is used as a means of multiplying the frequency of the output signal produced in the preceding tripler circuit. Harmonic generator diode CR1, being a nonlinear device, distorts the signal from the tripler, and develops a signal having a large harmonic content. This signal is coupled through C9 into the harmonic selector tuned-line cavity of the mixer. In the harmonic selector cavity, C5 is adjusted to tune the cavity at the ninth harmonic of the crystal oscillator frequency. The resultant final local oscillator signal is applied to the base of the mixer, Q2.

5-20. I-F AMPLIFIER. The output of the mixer is a 33.5 megacycle signal containing the frequency modulation of the original carrier. This signal is amplified in the i-f amplifier which drives the FM ratio detector and carrier detector circuits.

5-21. The i-f amplifier consists of five stages which are physically part of the i-f video amplifier subassembly in the receiving unit assembly. The center frequency of the i-f amplifier is 33.5 megacycles. (Refer to figure 9-1, sheet 1.)

5-22. All five i-f stages are identical. The i-f input signal is applied to the emitter of Q1. Q1 is a PNP transistor connected as a grounded base amplifier. The signal is amplified and developed across the collector load, L1 and T1, and coupled through T1 to the following stage. L1 is used in conjunction with the adjustable secondary of T1 to adjust the frequency responses of the stage.

5-23. Amplifier stages Q2, Q3, Q4, and Q5 operate in a similar manner, except for a tap on the secondary of T4 which provides a portion of the i-f signal for application to the carrier detector circuit, CR5. The carrier detector circuit is fully described in paragraph 5-38. The i-f amplifier output is coupled from the collector of Q5 to the FM ratio detector.

5-24. Emitter voltage for all stages is provided by the 13 volt d-c supply through R11 and thermistor RT1, which compensates for temperature changes that would shift the operating points of the transistors. In the case of a temperature rise, emitter current increases, causing a corresponding decrease (less positive) in emitter voltage due to the increased drop across the emitter resistor. The temperature rise also causes the thermistor resistance to decrease, thus increasing the supply voltage applied to the emitters of all stages and thereby compensating for the initial emitter voltage decrease.

5-25. FM DETECTOR. The FM detector (figure 9-1, sheet 1) is a modified ratio detector which provides an audio signal output proportional to the frequency deviation of the input signal. The output signal is coupled to the video amplifier. This signal is the composite audio signal, which may consist of as many as six distinct audio frequencies in the range from 7500 cycles to 73,950 cycles. The FM ratio detector is physically a part of the i-f video amplifier of the receiving unit assembly.

5-26. CR1 and CR2 with the associated circuit constitute the ratio detector. The i-f output signal is developed across T5, and the quadrature voltages are applied to the diodes through C28 and C29. CR3 is a zener diode which acts to hold the average output d-c level constant to compensate for extreme amplitude deviations of the input signal. The output composite audio signal is developed across C32 and coupled through C33 to the video amplifier.

5-27. VIDEO AMPLIFIER. The video amplifier amplifies the composite audio output from the FM ratio detector and drives the output audio amplifier. The video amplifier is physically part of the i-f video amplifier subassembly in the receiving unit assembly.

5-28. As shown in figure 9-1, sheet 1, the input signal from the FM ratio detector is coupled through C33 to the base of Q6, the first stage of the video amplifier. Q6 is a PNP type transistor connected as an emitter follower, the output being developed across the emitter load resistor R15. This signal is direct-coupled to the base of Q7. Q9 is a PNP transistor with its emitter and base connected together to operate as a diode and together with R12, R13, C34, and R22, constitutes a temperature compensating network.

5-29. Q7 is a PNP type transistor connected as a common emitter amplifier. The gain of the video amplifier can be controlled by adjusting the emitter bias of Q7. The emitter bias is adjusted by the use of R16. The output is direct-coupled to the base of the output emitter follower, Q8.

5-30. Q8 is an NPN type transistor connected as an emitter follower. The d-c voltage level feedback from the emitter of Q8 to the input of Q6 is part of the temperature compensating network for Q6. The composite audio output signal from Q8 is developed across R19 and R20 and applied, through R21, R12, and pin 1 of J1, to the audio output amplifier circuit. C19 provides filtering of any i-f component.

5-31. AUDIO OUTPUT AMPLIFIER. The audio output amplifier receives the composite audio signal from the video amplifier. This signal is amplified and coupled into the audio decoders. The audio output amplifier circuit is physically located on the ancillary circuit board. Refer to figure 9-1, sheet 2.

5-32. The composite audio signal from the video amplifier is developed across R5 and coupled through C3 to the primary of T1. Switch S1 is used to limit the amount of signal applied to Q3 and Q4 when the r-f carrier signal is being deviated the maximum allowable 300 kc. The magnitude of the composite audio signal is greater with 300 kc carrier deviation than with 120 kc carrier deviation; therefore, for 120 kc carrier deviation, the audio input signal is developed across only part of the primary of T1, while for 300 kc deviation the entire primary of T1 is used and part of the applied signal is dropped across R6. Q3 and Q4 are PNP type transistors connected as a push-pull amplifier. Base bias for Q3 and Q4 is developed across R7. The output composite audio signal is developed across T2 and applied through contacts of the carrier relay, R21B, to the audio decoders.

5-33. When K21 (carrier relay) is deenergized, its contacts open the audio output line from T2 to the decoders and also ground the decoder inputs. When K21 is energized, the composite audio signal is coupled to the audio decoders. The operation of the carrier relay, K21, is controlled by the carrier detector circuit, which is described in paragraph 5-38.

5-34. AUDIO DECODERS. The composite audio signal from the audio output amplifier is applied to all 20 audio decoders in parallel, as shown in figure 5-3. The tuned transformer input circuit of each audio decoder passes only the audio frequency to which it is tuned and rejects all other frequencies. When the proper audio frequency appears at its input, it is passed to the audio amplifier. There the signal is amplified and passed to the relay driver, which energizes its associated relay. The relay is thus energized upon receipt of the proper audio frequency. The output connections of the 20 output relays are shown in figure 9-1, sheet 2.

5-35. Physically, there are five decoder subassemblies, each with four separate audio decoders. All five of the decoder subassemblies are identical and, therefore, only one is shown in figure 9-1, sheet 3. All 20 decoders are identical, except for the values of the two input capacitors, the tuning of the input transformers in each channel, and the values of the first stage load resistors. The following description of the channel 1 decoder circuit is typical for all channels. Refer to figure 9-1, sheet 3.

5-36. The composite audio signal is applied through E1A2, pin 3, to all 4 decoders on the subassembly in common. The channel 1 decoder input signal is

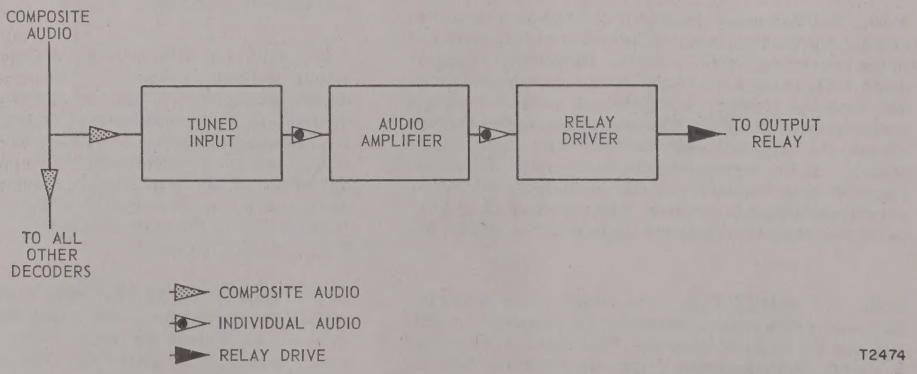


Figure 5-3. Audio Decoder Block Diagram.

developed across C1 and the primary of transformer T1 and transformer-coupled to the base of Q1. T1 and T2 are tuned, and the values of C1 and C2 are selected so that maximum transfer occurs at the desired audio frequency. Q1 is a PNP transistor, used as class B audio amplifier. Emitter supply voltage is developed from the +27.5 volts dc supply across the voltage divider R1 and R2. C3 bypasses the signal around R2 to eliminate degenerative feedback. The base of Q1 is biased approximately at cutoff. The negative half cycles of the input audio signal are amplified and developed as positive pulses across the collector load, R3. The positive pulsating input to Q2 causes Q2 to conduct and energize the output relay K1 which is the collector load for Q2. Capacitor C4 and the inductance of K1 serve to filter the a-c component of the Q2 output. Temperature compensation is provided by the action of CR3 on the ancillary circuit board, which operates with R11 as a voltage divider to supply base bias (slightly less than 27.5 volts dc) to the base of Q1.

5-37. OUTPUT RELAYS. Each of the 20 decoders drives its respective output relay, K1 through K20. The common sides of all the relay coils are tied together and returned, through R4, to the +27.5 volts dc line (figure 9-1, sheet 2). The relay contacts are made available at J2 and J3 for connection of external circuits. R4 is in the circuit test purposes. Since all relays return to +27.5 volts dc through R4, the voltage drop across R4 (at J2, pin G) is an indication of relay current.

5-38. CARRIER DETECTOR CIRCUIT. The carrier detector circuit (figure 5-1) prevents application of the composite audio signal to the audio decoders unless the received r-f carrier signal strength exceeds a certain minimum level. It also provides an indication to external circuits by means of a set of single-pole, double-throw relay contacts connected to connector J3.

5-39. Refer to figure 9-1, sheet 1. A portion of the i-f signal is tapped from T4 and coupled to the carrier detector, CR5, which rectifies the signal. The rectified signal (positive half-cycles) is filtered by the action of C38 and R25. Additional filtering of the carrier detector output is provided by R24 and C18. The output from the carrier detector circuit is a positive d-c voltage level that is proportional to the strength of the received carrier signal. This signal is coupled through RT1, which provides temperature compensation, and out of the receiving unit through J1, pin 5, to the carrier detector amplifier on the ancillary circuit board (figure 9-1, sheet 2).

5-40. The carrier detector output voltage is applied to the base of Q1, an NPN transistor. The voltage is amplified and applied to the base of Q2 (PNP) which drives K21 (carrier relay) in the collector circuit of Q2. Capacitor C1, with the relay coil inductance, filters any remaining ac component in the relay drive voltage. The carrier relay sensitivity control, R1, adjusts the operating point of Q1. R1 is set so that the carrier relay will be energized when the signal strength of the received carrier at ANT. INPUT connector J1 is greater than 10 microvolts. This setting of R1 should also cause K21 to drop out at about 5 microvolts signal strength.

5-41. When K21 is deenergized, one set of its contacts (internal control), opens the composite audio signal lead from the secondary of T2 and also grounds the input to all the audio decoders, thereby preventing the composite audio signal from being coupled to the decoders. When K21 is energized, the ground is removed from the input of the decoders and the signal path from the secondary of T2 is completed. The external control contacts of the carrier relay are available at connector J3.

5-42. VOLTAGE SUPPLY CIRCUITS. The radio receiver includes several circuits that operate from the 27.5 volts dc supply and provide lower operating and bias voltages for the transistor circuits. As shown in figure 9-1, sheet 2, +13 volts dc and +9.7 volts dc are provided for the r-f, i-f, and video amplifier, local oscillator, and mixer. The +13 volts dc is produced by the voltage divider of R10 and CR1. Diode CR1 is a zener diode and maintains a constant drop of 13 volts yielding +13 volts dc at the junction of R10 and CR1. The +9.7 volts dc is produced by the divider action of CR2 and R9. CR2 has a zener voltage of 3.3 volts; therefore, with +13 volts dc applied to CR2, +9.7 volts dc appears at the junction of CR2 and R9. The 13 volts dc is also supplied through J1, pin 4, to Q1, the carrier detector amplifier.

5-43. The audio output amplifier (figure 9-1, sheet 1) is supplied with 5.6 volts dc by the divider action of R10 and CR2. The 5.6 volts dc is applied through R8 and R9 to the base and emitter circuits of Q3 and Q4 in the audio output amplifier and to the emitter circuits of all 20 relay driver stages (Q2, Q4, Q6, Q8) in the decoders.

5-44. The base bias voltage for all 20 audio amplifier stages (Q1, Q3, Q5, Q7) in the decoders is developed across R11 which is connected, in series with CR1 directly to the 27.5 volts dc line. This is a temperature compensating network. CR1 is connected in the forward direction, its resistance varying with temperature. This changes the bias applied to the decoder audio amplifiers to compensate for transistor changes with temperature.

SECTION VI

ORGANIZATIONAL MAINTENANCE

6-1. GENERAL.

6-2. This section outlines the maintenance that can be performed on the Radio Receiving Set AN/DRW-29 at the organizational level. Organizational maintenance consists of: (1) minimum performance standards test and corrective action indicated therein; (2) carrier loss relay adjustment; (3) a visual inspection; and (4) plug-in assembly removal procedures. The minimum performance standards test is designed to localize troubles that can be remedied by adjustments and replacement of defective plug-in assemblies. Plug-in assemblies needing alignment are to be replaced by spares and referred to field maintenance activity.

6-3. MINIMUM PERFORMANCE STANDARDS TEST.

6-4. The minimum performance standards test for the radio receiver is given in table 6-1. Each step of the minimum performance standards test contains instructions and control settings required for the test, and the normal indications to be expected. The radio receiver can be considered as operating satisfactorily if all the requirements of the test are met.

6-5. If an indication is abnormal at any point during the test procedure, refer to the "possible cause and remedy of abnormal indication" column in order to return equipment to normal operating condition. Before replacing defective assemblies, perform the preliminary inspection of paragraph 6-8.

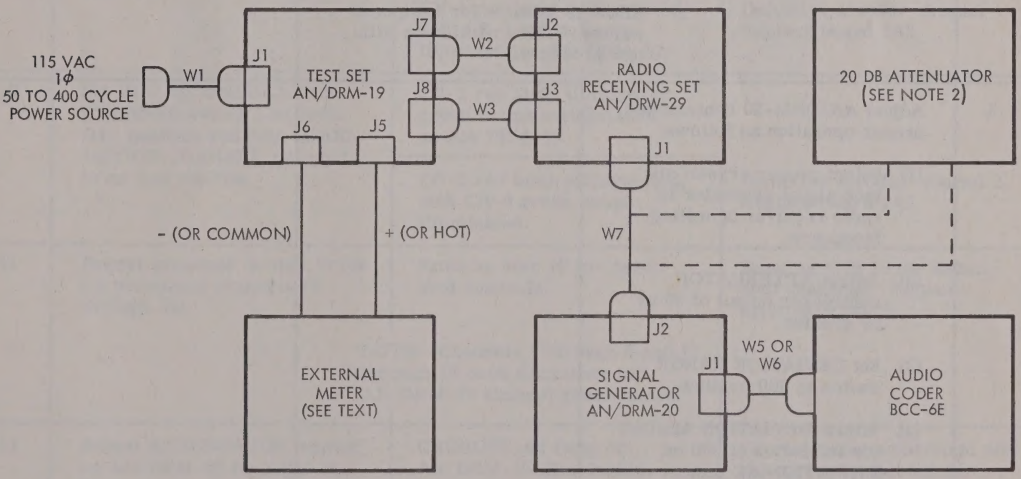
6-6. The minimum performance standards test is designed so that the procedures can be performed with the radio receiver in its case. The connections for the test are shown in figure 6-1.

6-7. CARRIER DETECTOR SENSITIVITY ADJUSTMENT. The following procedure is used, when indicated in table 6-1, to adjust the sensitivity of the carrier detector circuit for proper operation. Refer to figure 6-2 for location of controls. Proceed as follows:

1. Remove radio receiver from its case (paragraph 6-14).

2. Connect test equipment to radio receiver as shown in figure 6-3.

NOTE: The 20 db fixed attenuator must be used for this test setup.



NOTES:
1. TEST CABLE FURNISHED WITH AN/DRM-20 TEST SET.
2. 20 DB ATTENUATOR USED DURING CARRIER DETECTOR SENSITIVITY ADJUSTMENT ONLY. ALL OTHER TESTS USE DIRECT CABLE CONNECTIONS.

T2475

Figure 6-1. Minimum Performance Standards Test Setup.

TABLE 6-1. RADIO RECEIVER MINIMUM PERFORMANCE STANDARDS TEST

Step	Control Settings and Instructions	Normal Indications	Possible Cause and Remedy of Abnormal Indications
1	Connect radio receiver to test equipment as shown in figure 6-1.		
2	Set controls on BCC-6E coder as follows:		
	MODULATION CHANNELS switches 1 through 20 to down (off) positions.		
	COMPRESSOR switch to IN position.		
	POWER switch to ON position.		
3	Set AN/DRW-20 POWER and CARRIER switches to ON position.		
4	Apply 115 v ac to AN/DRM-19 test set, test set MAIN POWER switch to ON position and adjust test set POWER SUPPLY ADJ control for 27.5v dc POWER SUPPLY VOLTAGE meter indication.		
	Allow 20 minutes for equipment warmup before continuing with test procedure.		
5	Adjust AN/DRM-20 controls for proper operation as follows: (1) Select proper crystal and tune signal generator to radio receiver operating frequency. (2) Adjust ATTENUATOR control for output of 20 uv or greater. (3) Set DEVIATION RANGE switch to 300 position. (4) Adjust DEVIATION ADJUST for indication of 300 on DEVIATION KC meter.		
	NOTE: If the radio receiver is set for 120 kc deviation, set DEVIATION RANGE to 150 and adjust for 120 on DEVIATION KC meter (steps 5(3) and 5(4).		

TABLE 6-1. RADIO RECEIVER MINIMUM PERFORMANCE STANDARDS TEST - CONTINUED

Step	Control Settings and Instructions	Normal Indications	Possible Cause and Remedy of Abnormal Indications
6	Observe AN/DRM-19 radio test set indications.	CARRIER green lamp illuminates.	Carrier loss relay improperly adjusted. Refer to paragraph 6-8.
			Receiving unit improperly tuned. Replace receiving unit.
		CH-1 through CH-20 red lamps illuminated.	Illuminated green lamp indicates defective channel relay. Replace channel relay.
			Neither lamp illuminated indicates defective channel relay contacts. Replace channel relay.
7	Connect multimeter leads to J5(+) and J6(-) on AN/DRM-19 and set TEST POINT SELECTOR switch to LO TEST position.	3.5 v dc	Crystal Y1 defective. Replace crystal.
			Receiving unit defective. Replace receiving unit.
8	Set TEST POINT SELECTOR switch to AUDIO OUPUT position.	0 v ac	
9	Set BCC-6E MODULATION CHANNEL switch 1 to up (on) position.	Multimeter indicates approximately 0.6 v ac.	Receiving unit defective. Replace receiving unit.
		CH-1 red lamp extinguished, both CH-1 green lamps illuminate on AN/DRM-19.	Defective decoder channel 1. Replace board 1A2.
10	Set BCC-6E MODULATION CHANNEL switch 1 to down (off) position and turn MODULATION CHANNEL switch 2 to up (on) position.	CH-1 red lamp illuminated green lamps extinguished on AN/DRM-19.	
		CH-2 red lamp extinguished, both CH-2 green lamps illuminated.	Defective decoder channel 2. Replace board 1A2.
11	Repeat sequence of step 10 for all remaining channels (3 through 20).	Same as step 10 for associated channels.	Same as step 10 for associated channels. Replace applicable board.
		NOTE: Channels 1 through 5 and 11 through 15 each illuminate two AN/DRM-19 channel green lamps.	
12	Adjust ATTENUATOR control on AN/DRM-20 for input of 5 uv.	CARRIER red lamp on AN/DRM-19 illuminated.	Carrier relay adjustment not set correctly (paragraph 8-13).
13	Adjust ATTENUATOR control on AN/DRM-20 for input of 10 uv.	CARRIER green lamp on AN/DRM-19 illuminated.	Carrier relay adjustment not set correctly (paragraph 8-13).
14	Turn off and disconnect all test equipment.		

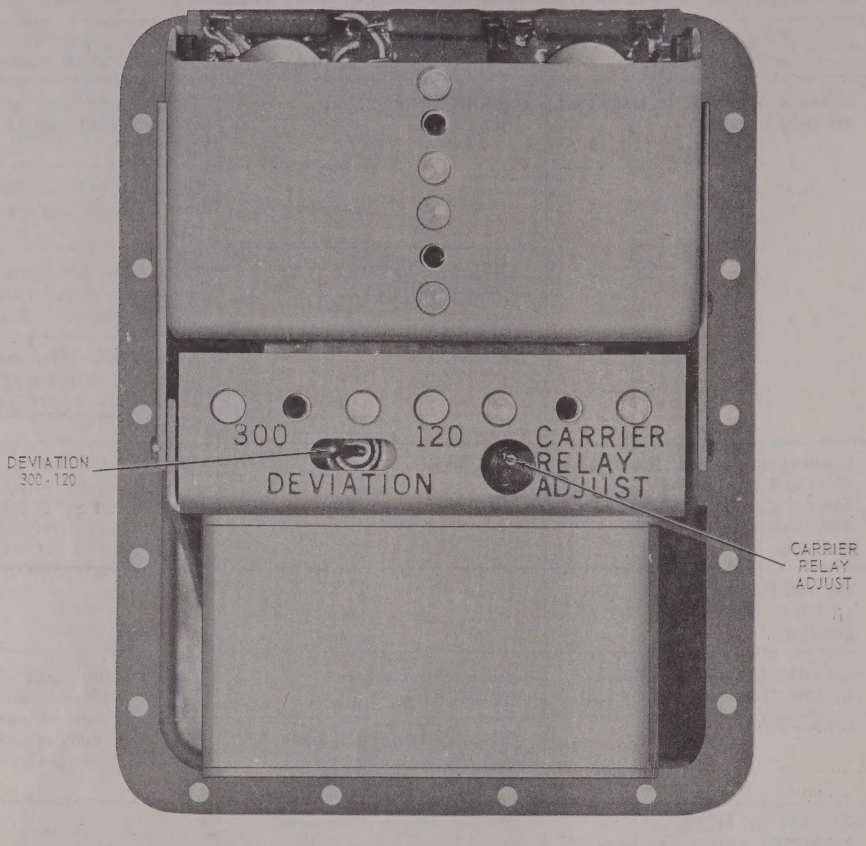


Figure 6-2. Radio Receiver Adjustment Location.

3. Perform steps 2 through 5 of table 6-1.

4. Adjust AN/DRM-20 for output level of 9 uv. Green CARRIER lamp on AN/DRM-19 may or may not be illuminated at this time.

5. Set radio receiver DEVIATION 300-120 switch to 120 position.

6. Adjust CARRIER RELAY ADJUST potentiometer until green CARRIER lamp on AN/DRM-19 is illuminated, then reverse to point at which green lamp is extinguished and the red lamp is illuminated.

7. Increase AN/DRM-20 output until green CARRIER lamp is lighted. This should occur at AN/DRM-20 output level of 10 uv or slightly less. Adjust CARRIER RELAY ADJUST if necessary.

8. Decrease AN/DRM-20 output until red CARRIER lamp is illuminated. This should occur at level of not less than 5 uv. If necessary, readjust CARRIER RELAY ADJUST slightly and repeat steps 7 and 8.

9. Remove operating power from all test equipment.

10. Disconnect test equipment from radio receiver.

11. Replace radio receiver in its case.

6-8. PRELIMINARY INSPECTION.

6-9. The preliminary inspection list given in table 6-2 lists items that should be visually inspected for signs of damage whenever the radio receiver does not meet minimum performance standards. If the preliminary inspection does not reveal the source of the trouble, replace defective (or mis-aligned) assembly.

6-10. REMOVAL AND REPLACEMENT.

6-11. The following paragraphs provide procedures for gaining access to each of the assemblies that can be replaced at the organizational maintenance level. Refer to section XI for disassembly illustrations.

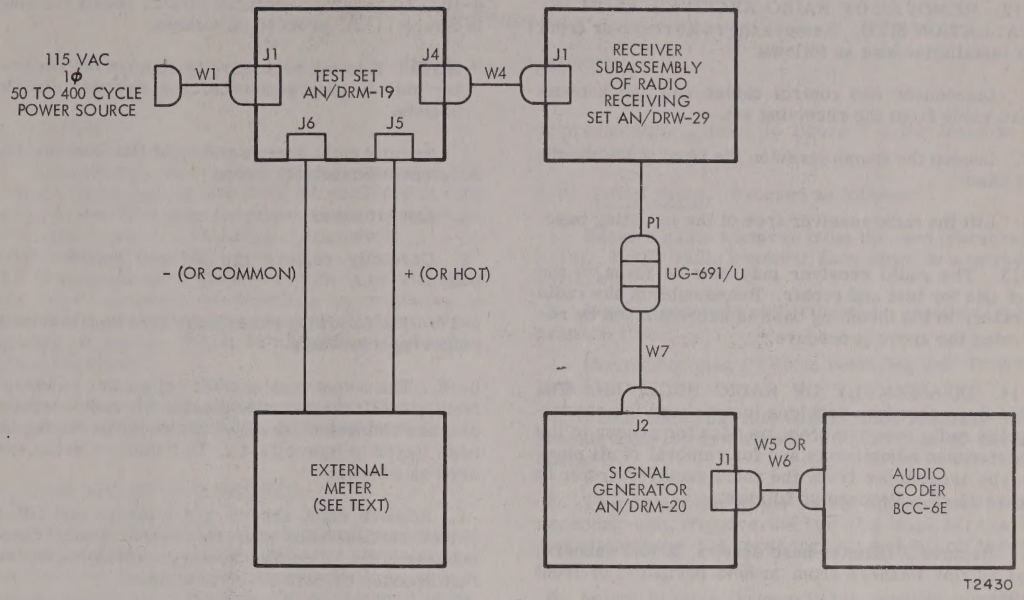


Figure 6-3. Adjustment Test Setup.

TABLE 6-2. PRELIMINARY INSPECTION

Part	Specific Condition	Remedy
Plug-in circuit boards	Examine for secure seating and good connection to jack.	Clean contacts.
		Seat securely.
Connectors	Examine for: 1. Bent or broken pins 2. Broken or chipped inserts 3. Crossed damaged threads 4. Corroded contact surfaces	For conditions 1 through 3, replace defective connectors.
		For condition 4, clean contacts with approved mineral-base solvent.
Relays	Examine for broken solder hooks or damaged cases.	Replace.
Resistors	Examine for broken leads, distorted or burned condition.	Replace.
Capacitors	Examine for broken leads, distorted or burned condition.	Replace
Coils	Examine for loose mountings, burned or open windings, or deteriorated windings.	Tighten loose mountings.
		Replace damaged coils.
Wiring	Examine for burned or worn insulation.	Repair as required.
	Examine all solder joints for loose connections or cold solder joints.	Repair as required.
Mounting hardware	Make thorough inspection of mounting hardware for evidence of looseness.	Tighten mounting hardware as required.

6-12. REMOVAL OF RADIO RECEIVER FROM INSTALLATION SITE. Remove the radio receiver from the installation site as follows:

1. Disconnect two control cables and the antenna input cable from the receiving set.

2. Loosen the thumb screw on the front of the mounting base.

3. Lift the radio receiver free of the mounting base.

6-13. The radio receiver may now be taken to the test site for test and repair. Reassembly of the radio receiver to the mounting base is accomplished by reversing the above procedure.

6-14. DISASSEMBLY OF RADIO RECEIVER. The following procedure provides instructions for removing the radio receiver from its case for access to the maintenance adjustments and for removal of all plug-in type assemblies from the radio receiver (refer to figure 11-2). Proceed as follows:

1. Remove 20 fillister-head screws, 20 lockwashers, and 20 flat washers from around periphery of front panel.

2. Remove four seal screws from rear of radio receiver.

3. Slide radio receiver from its case. This provides access to two maintenance adjustments at rear of radio receiver.

6-15. To remove the receiving unit (for replacement or testing) proceed as follows:

1. Disconnect plug P1 from receiving unit jack J1.

2. Disconnect the antenna input plug from the input jack on the radio receiver front panel.

3. Disengage the four captive screws on the sides of the receiving unit.

4. Lift out the receiving unit.

6-16. To remove a decoder circuit board (as shown in figure 11-2), proceed as follows:

NOTE: It is not necessary to remove the receiving unit to gain access to the decoder circuit boards.

1. Remove eight screws and eight flat washers from receiver subassembly cover.

2. Lift off cover.

3. Carefully remove the desired decoder circuit board.

6-17. The following paragraphs give instructions for removing the relays.

6-18. The output and carrier relays are mounted on front panel chassis subassembly of radio receiver, and are connected directly into receiver wiring harness (refer to figure 11-5). To remove a relay, proceed as follows:

1. Remove eight screws and washers and lift receiver subassembly away from front panel chassis subassembly. Position receiver subassembly such that decoder chassis cover is visible.

2. Locate relay to be replaced, using information printed on decoder chassis cover.

3. Unsolder relay leads one by one, tagging leads with number of relay contact.

4. Remove two screws and lockwashers which hold relay in place and lift out relay.

NOTE: There are two types of relays mounted on the front panel; relays K1 through K5, K11 through K15, and K21 and dpdt types; relays K6 through K10 and K16 through K20, which look exactly the same from the bottom, are spdt types. The relay types are oriented in opposite directions.

6-19. Replacement of decoder circuit boards, the receiving unit, the receiving unit cover, or the output and carrier relays is accomplished by reversing the sequency of the appropriate preceding paragraphs.

SECTION VII

FIELD MAINTENANCE

7-1. GENERAL.

7-2. This section outlines field level maintenance for the Radio Receiving Set AN/DRW-29. Included in this section is the operating frequency change procedure (r-f amplifier and local oscillator alignment).

7-3. Organizational maintenance activities will normally have remedied malfunctions by replacing a defective non-repairable assembly. Assemblies requiring alignment, should be aligned by field maintenance personnel.

7-4. If assembly referred from organizational maintenance activity can not be aligned, it must be replaced.

7-5. ALIGNMENT PROCEDURES.

7-6. The following paragraphs contain alignment procedures which can be performed on the receiving unit when referred to field maintenance activity by organizational maintenance personnel or whenever it is desired to change the frequency of the receiving unit.

7-7. To change the operating frequency of the receiving unit, it is necessary to perform the r-f amplifier and local oscillator alignment procedures in the order of presentation. Refer to figure 7-1 for location of adjustments.

7-8. Initial Setup. Proceed as follows:

1. Remove radio receiver from its case (paragraph 6-14). Place radio receiver face down on a working surface.

2. Remove receiving unit from radio receiver (paragraph 6-15).

3. Disconnect plug P1 from receiving unit POWER jack J1.

4. Place receiving unit beside radio receiver main chassis with top upward and POWER jack J1 toward operator.

5. To gain access to the tuning adjustments in the receiving unit, remove the two flat head screws on opposite ends of the receiving unit and lift off the top cover.

6. Select crystal frequency for desired operating frequency from table 1-5. Note that operating frequencies between 473 and 483 mc can be obtained with crystal frequencies between 48.83333 and 49.94444 mc (HI mode) or crystal frequencies between 56.27777 and 57.38888 mc (LO mode).

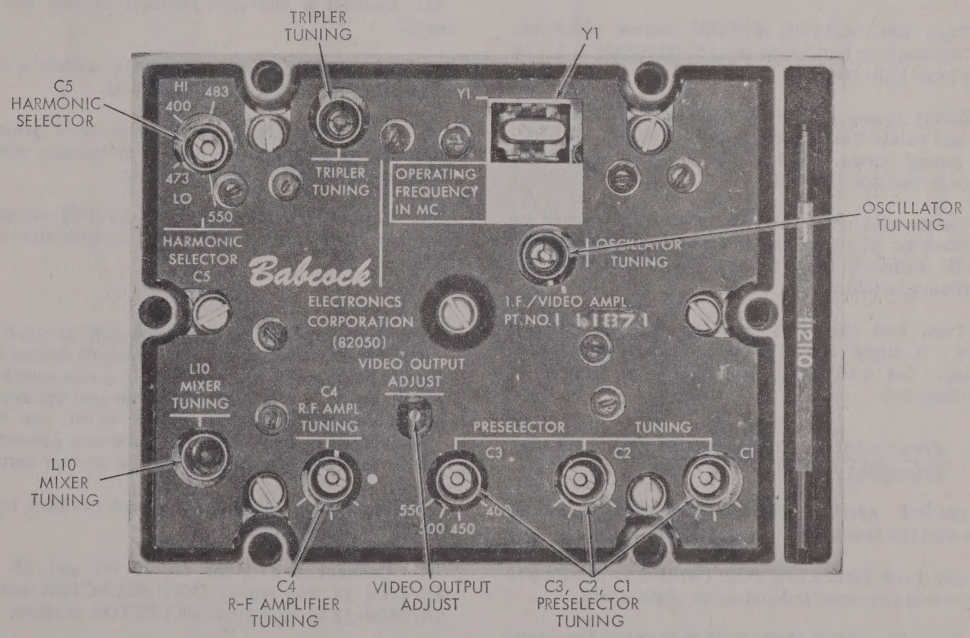


Figure 7-1. Receiving Unit Adjustment Location.

7. Install required crystal in its socket (figure 7-1), using pair of long nose pliers or large tweezers. Write new operating frequency in space provided below Y1, and note whether crystal provides HI or LO mode of operation.

8. Connect test equipment to receiving unit as shown in figure 6-3.

9. Perform steps 2 through 5 of table 6-1. Allow sufficient time for warmup, then continue with procedure of paragraph 7-9.

7-9. Local Oscillator Alignment Procedure. After completing the procedure of paragraph 7-8, proceed as follows (refer to figure 7-1 for location of adjustment points):

1. Connect multimeter leads to J5 and J6 of AN/DRM-19. Position TEST POINT SELECTOR switch to LO test position.

2. Adjust OSCILLATOR TUNING screw until upscale indication is obtained on multimeter. This indicates that oscillator is oscillating. Set OSCILLATOR TUNING screw at position which gives maximum indication on multimeter.

3. Adjust TRIPLER TUNING screw until maximum multimeter deflection is obtained. At optimum tuning, this reading should be at least 3.5 volts, the actual value depending on frequency to which oscillator is tuned.

4. Turn OSCILLATOR TUNING screw clockwise until multimeter indication is approximately 0.1 volt below peak indication.

5. Insert tuning tool in HARMONIC SELECTOR C5 slot, and rotate it until it engages HARMONIC SELECTOR tuning screw. Notice that tool and screw will engage in one position only.

6. Rotate tool until hairline is in area marked on face plate as HI (if operating frequency was selected from HI column in table 1-5) or LO (if selected from LO column in table 1-5).

7. Turn tool back and forth between HI (or LO) limits. A slight dip will be noticed in multimeter reading. Set HARMONIC SELECTOR C5 at point of maximum dip.

7-10. Preselector and R-f Amplifier Alignment Procedure.

1. Set R.F. AMPL TUNING capacitor C4 to approximate desired frequency on plate scale.

2. Set three PRESELECTOR TUNING capacitors to approximate desired frequency on plate scale.

3. Connect a-c vtvm leads to J5 (hot) and J6 (common) of AN/DRM-19, set TEST POINT SELECTOR switch to AUDIO OUTPUT position, and select an a-c vtvm range which provides on-scale indication.

4. Adjust AN/DRM-20 ATTENUATOR control to increase modulated output until a-c vtvm indication is reduced by 6 db. This establishes a receiver noise quieting figure of 6 db. In the following steps, it is important to maintain AN/DRM-20 output level at point such that receiver noise quieting figure remains at 6 db.

5. Adjust PRESELECTOR TUNING capacitor C1 for minimum a-c vtvm indication.

6. Reduce AN/DRM-20 output to 6 db receiver noise quieting level.

7. Repeat steps 5 and 6 several times to obtain maximum receiver sensitivity.

8. Repeat steps 5 and 6 for PRESELECTOR TUNING capacitor C2.

9. Repeat steps 5 and 6 for PRESELECTOR TUNING capacitor C3.

10. Repeat steps 5 and 6 for R. F. AMPL TUNING capacitor C4.

NOTE: PRESELECTOR TUNING capacitors C1, C2, and C3 should not be adjusted after the r-f amplifier is tuned.

11. Readjust HARMONIC SELECTOR capacitor C5 for maximum conversion gain, as indicated by a slight increase in the a-c vtvm indication.

12. Connect a 560-ohm resistor across the vtvm leads.

13. Set MODULATION CHANNEL switch 1 on the BCC-6E coder to the on (up) position.

14. Adjust the AN/DRM-20 controls to produce a 1000 microvolt signal at center frequency with the modulation deviation set at ±300 kc.

15. Adjust the VIDEO OUTPUT ADJUST potentiometer to obtain 0.6 volt ac output as indicated by the vtvm.

CAUTION

The mixer tuning (steps 16 through 20) is a factory adjustment and should not be changed during routine alignment of the receiver to a new operating frequency. However, in the event that the setting of the MIXER TUNING control (L10) has been inadvertently disturbed, the following procedure may be used to return it to the proper setting.

16. Disconnect the a-c vtvm and resistor from J5 and J6 of AN/DRM-19.

17. Connect d-c vtvm to J5 (+) and J6 (-) of AN/DRM-19 and leave TEST SELECTOR switch of AN/DRM-19 in CARRIER DETECTOR position.

18. Set MODULATION CHANNELS switches 1 through 20 of BCC-6E to down (off) position and reduce output of AN/DRM-20 to zero.

19. Observe d-c vtvm indication and then slowly increase unmodulated output of AN/DRM-20 to level which increases d-c vtvm indication by factor of two. This establishes signal-to-noise ratio of 2:1.

20. Carefully adjust L10 for maximum obtainable d-c vtvm indication.

21. Reduce output of AN/DRM-20 to zero and repeat steps 18 and 19. This sequence should be repeated sufficient number of times to ensure optimum tuning.

22. Remove power from AN/DRM-19 and disconnect AN/DRM-19 and AN/DRM-20 from receiving unit.

23. Reconnect receiving unit connectors to radio receiver, replace receiving unit cover plate, and secure receiving unit to radio receiver.

24. Remove operating power from all test equipment.

25. Replace radio receiver in its case.

SECTION VIII

OVERHAUL INSTRUCTIONS

Not applicable.

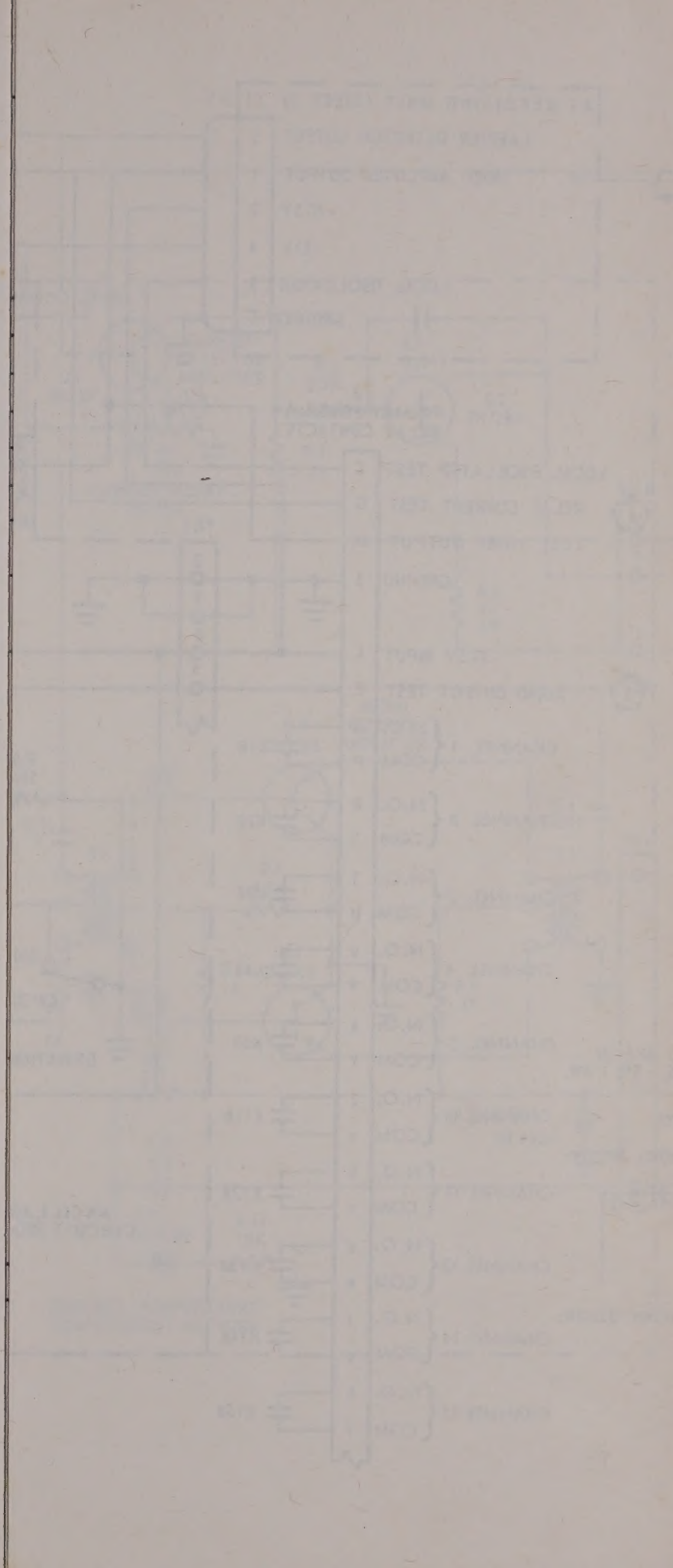
SECTION IX

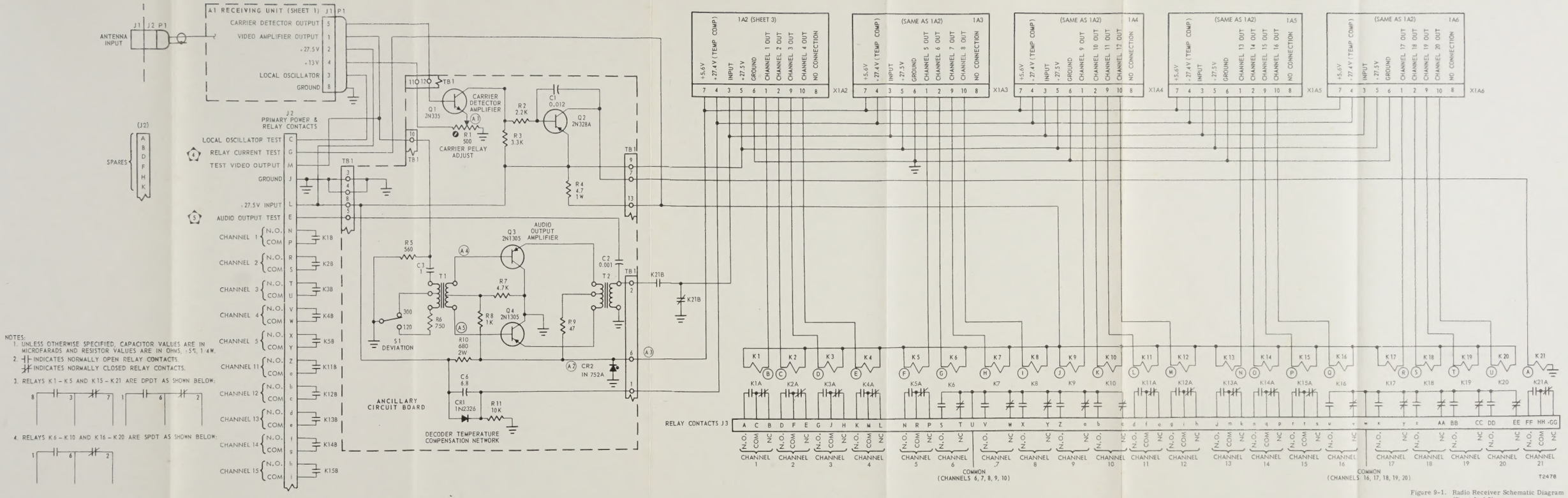
DIAGRAMS

9-1. GENERAL.

9-2. This section contains the schematic diagram of the radio receiver. It is recommended that maintenance personnel study the schematic diagram before attempting maintenance or replacement of parts.

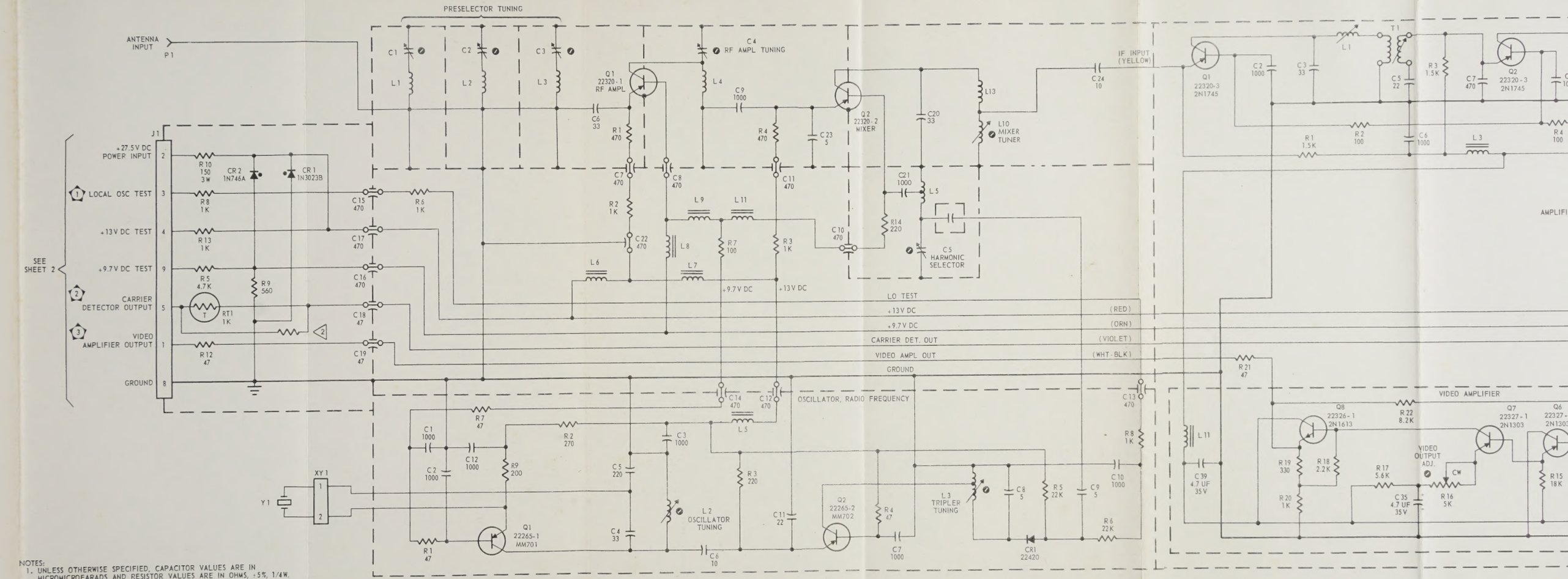
9-3. Figure 9-1, sheet 1, shows the ancillary circuit board, decoder circuit board connections, and the remainder of the circuits in the radio receiver. Sheet 2 shows receiving unit assembly. Sheet 3 shows the schematic diagram of a typical decoder circuit board. All electrical parts are shown, and each part is identified as to reference designation and principal electrical characteristics. All test points are also shown.





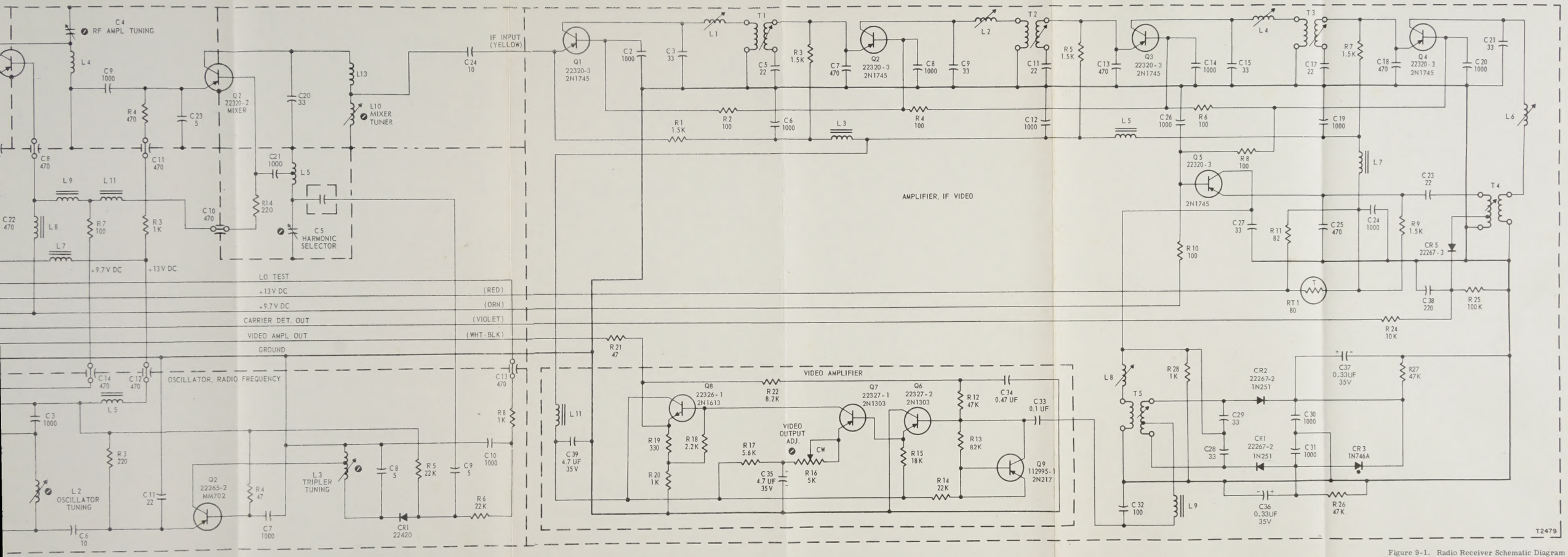
NOTES:
1. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN MICROFARADS AND RESISTOR VALUES ARE IN OHMS, ±5%, 1/4W.
2. ⊣⊢ INDICATES NORMALLY OPEN RELAY CONTACTS.
   ⊣/⊢ INDICATES NORMALLY CLOSED RELAY CONTACTS.
3. RELAYS K1 – K5 AND K15 – K21 ARE DPDT AS SHOWN BELOW:
4. RELAYS K6 – K10 AND K16 – K20 ARE SPDT AS SHOWN BELOW:

Figure 9-1. Radio Receiver Schematic Diagram (Sheet 1 of 3)



NOTES:
1. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN MICROMICROFARADS AND RESISTOR VALUES ARE IN OHMS, ±5%, 1/4W.
2. SELECTED VALUE BETWEEN 4.7K AND 33K OR RESISTOR MAY BE OMITTED.

RECEIVING UNIT A1



RECEIVING UNIT A1

Figure 9-1. Radio Receiver Schematic Diagram (Sheet 2 of 3)

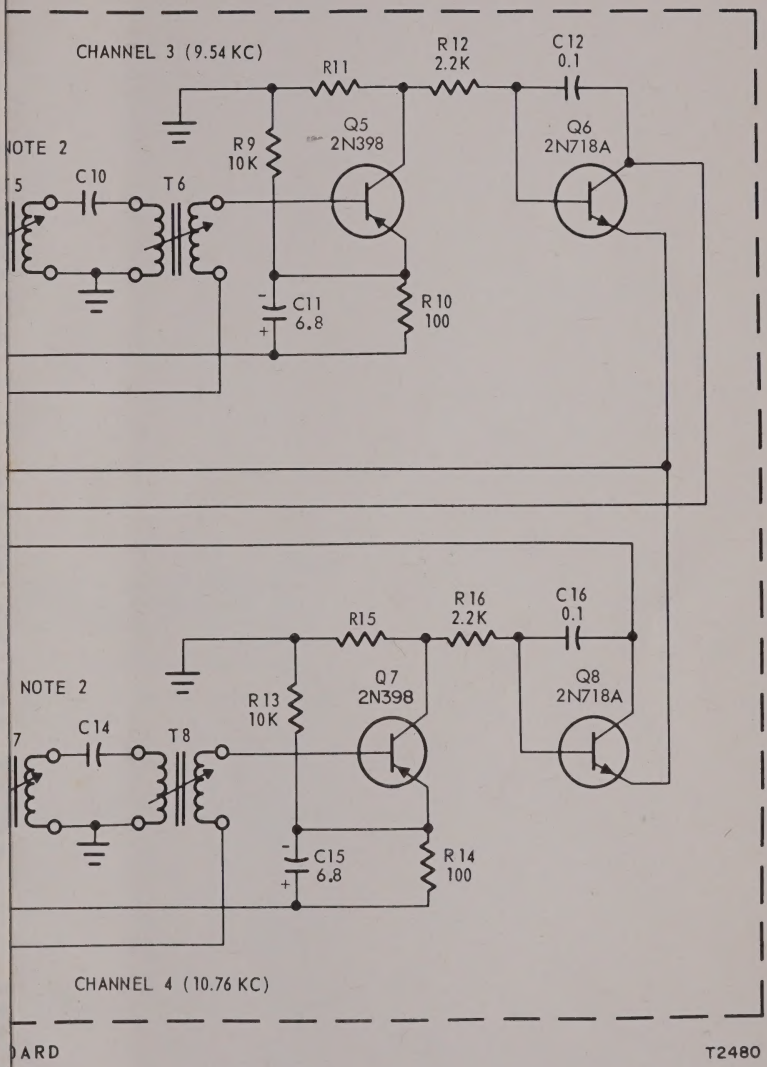
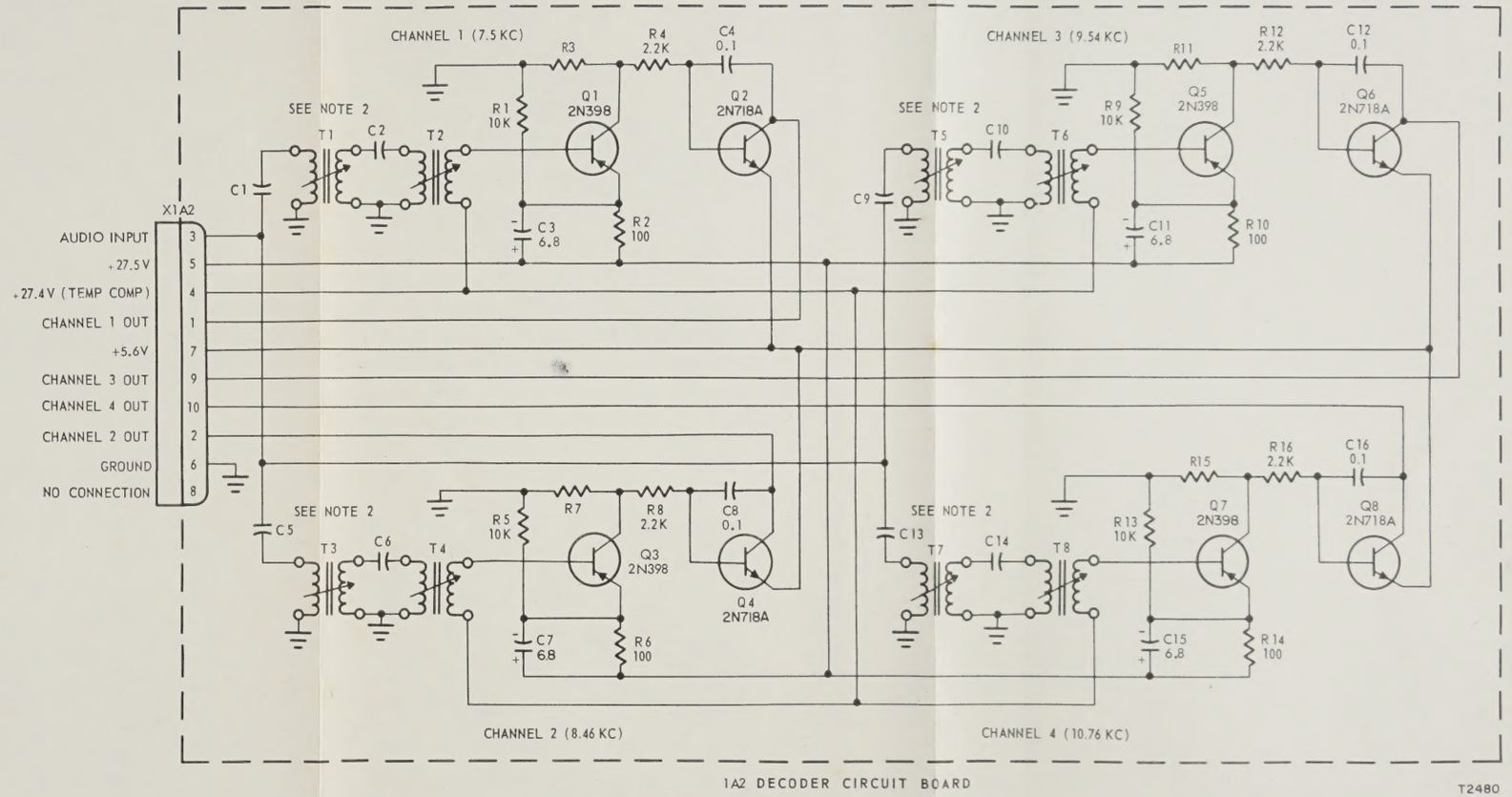


Figure 9-1. Radio Receiver Schematic Diagram (Sheet 3 of 3)

NOTES:
1. UNLESS OTHERWISE SPECIFIED, CAPACITOR VALUES ARE IN MICROFARADS AND RESISTOR VALUES ARE IN OHMS.
2. CM 20 MICA ±2% CAPACITORS, VALUE SELECTED FOR EACH CHANNEL.
3. R3, R7, R11 AND R15 VALUES SELECTED FOR EACH CHANNEL.

DECODER CIRCUIT BOARD									
1A2		1A3		1A4		1A5		1A6	
CHAN	FREQ (KC)	CHAN	FREQ (KC)	CHAN	FREQ (KC)	CHAN	FREQ (KC)	CHAN	FREQ (KC)
1	7.50	5	12.14	9	19.66	13	31.83	17	51.52
2	8.46	6	13.70	10	22.17	14	35.90	18	58.12
3	9.54	7	15.45	11	25.01	15	40.49	19	65.56
4	10.76	8	17.43	12	28.21	16	45.68	20	73.95



1A2 DECODER CIRCUIT BOARD

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Figure 9-1. Radio Receiver Schematic Diagram (Sheet 3 of 3)

SECTION X

INTRODUCTION TO ILLUSTRATED PARTS BREAKDOWN

10-1. IDENTIFICATION

10-2. Section XI, lists and describes parts for Receiving Set, Radio, AN/DRW-29, manufactured by Babcock Electronics Corporation, Costa Mesa, California.

10-3. SCOPE OF INFORMATION

10-4. Section XI, Group Assembly Parts List, consists of the breakdown of detailed parts of each unit. Exploded illustrations serve as a visual aid for identification of all component parts of each assembly. Index numbers on each illustration refer to the Group Assembly Parts List and indicate the order of disassembly. Component parts are indented to show their relationship to the complete assembly. Attaching parts immediately follow the item which they attach, and precede any components of that item.

10-5. In the "DESCRIPTION" column NHA stands for next higher assembly.

10-6. The "UNITS PER ASSY" column indicates the total quantity of each part required for the assembly or subassembly; this quantity is not necessarily the total used for the complete assembly. The letters "AR" inserted in this column indicate usage as required.

10-7. The part numbers and descriptions in the Group Assembly Parts List are used to identify the parts. The numerically-arranged index numbers are referenced to the exploded view and are commonly used for assistance in locating a part in the Group Assembly Parts List after it has been found in the Numerical Index.

10-8. Section XII, Numerical Index, consists of a numerically arranged parts list of each part used on the equipment. Figure and index numbers are given only for the first occurrence of standard parts in the Group Assembly Parts List. For non-standard parts, all figure and index numbers are listed.

10-9. USABLE ON CODE.

10-10. When variations exist between two or more similar assemblies listed together, the differences are indicated in the "USABLE ON CODE" column of the Group Assembly Parts List. Parts not found in all of the coded assemblies wil bear the code letter or letters for the particular assembly or assemblies in which they are found. When this column is left blank, parts are common to all assemblies.

10-11. CONTRACTOR'S PART NUMBERING SYSTEM

10-12. Department of the Navy Bureau of Naval Weapons basic part numbers are assigned chronologically as required. Dash numbers, when suffixed to basic part numbers, denote model variations such as port thread sizes,presence or absence of fittings, right or left-hand versions, et cetera, within a basic design.

10-13. SOURCE CODES AND DEFINITIONS.

10-14. Source codes, as applied to the Numerical Index, are codes which indicate to a consumer a source for a part required in the maintenance or repair of an aeronautical article. Specifically, these codes indicate whether the material is to be requisitioned from the supply system; to be manufactured; to be obtained from salvage; not to be replaced since the next higher assembly is to be installed; not to be replaced due to the impracticability of replacement; to be procured for the specific requirement; to use local discretion regarding obtaining a replacement; or that failure of the part indicates a requirement for complete overhaul or scrapping of the assembly or equipment.

10-15. P SERIES: ITEMS PURCHASED – SUPPLY SYSTEM STOCK.

10-16. CODE P is applied to items which are purchased in view of known or anticipated usage, and which are relatively simple to manufacture within the Navy, if necessary.

10-17. CODE P1 is applied to items which are purchased in view of known or anticipated usage, and which are very difficult, impractical, or uneconomical to manufacture by the Navy.

10-18. CODE P2 is applied to items for which little usage is anticipated, but which are purchased in limited quantity for insurance purposes. Items coded "P2" are difficult to manufacture, require special tooling stock not normally available within the Naval Establishment, or require long production lead time.

10-19. CODE P3 is applied to detail items which are purchased in quantity in accordance with the life expectancy of the part. Items coded "P3" are normally deteriorative in nature, and may require special storage conditions.

10-20. CODE P4 is applied to items which are procured only for initial outfitting or for special control and not carried in system stock for replenishment purposes.

10-21. M SERIES: MANUFACTURE – ITEMS NOT PURCHASED OR STOCK NUMBERED.

10-22. CODE MF is applied to items which are capable of being manufactured within Fleet activities. Items coded "MF" have no anticipated or relatively low usage; or else possess restrictive installation or storage factors.

10-23. CODE MO is applied to items which are capable of being manufactured within overhaul/rework activities. Items coded "MO" have no anticipated or relatively low usage, or possess restrictive installation or storage factors or are manufactured more economically by the government.

10-24. CODE MOA is applied to items to be manufactured by the prime overhaul/rework point when required.

10-25. A SERIES: ASSEMBLY – ASSEMBLY NOT PURCHASED.

10-26. Code AF is applied to assemblies which are not purchased but which are to be assembled within activities prior to installation. At least one of the items in the assembly must be a coded "P" item which carries an individual part number and description.

10-27. CODE AO is applied to assemblies which are not purchased but which are to be assembled within overhaul/rework activities prior to installation. At least one of the items in the assembly must be a coded "P" series item, which carries an individual part number and description.

10-28. CODE AOA is applied to items to be assembled by the prime overhaul/rework point when required.

10-29. N SERIES: NOT STOCKED – WILL BE PURCHASED ON DEMAND.

10-30. CODE N is applied to items which do not meet established criteria for stocking and which are readily available from commercial sources; i.e., nuts, bolts, screws, bead chains, et cetera.

10-31. CODE N1 is applied to Bureau of Yards and Docks Supply Office ("Y") cognizance items under fraction code "A" which are (1) commercially available to all continental United States activities, (2) authorized for local stocking at the retail level, (3) replenished by local purchase within the continental United States, (4) carried in wholesale stock only for overseas and fleet activities, and (5) stock numbered and published in the Navy Stock List of the Yards and Dock Supply Office.

10-32. X SERIES: NOT PROCURED – NORMALLY IMPRACTICAL FOR STOCKING, MAINTENANCE, OR MANUFACTURE.

10-33. CODE X is applied to items which, if damaged, would require uneconomical repair. The need for an item, or items coded "X" will normally result in a recommendation for retirement of equipment from service.

10-34. CODE X1 is applied to items for which purchase of the next larger assembly source coded in the "P" series is justified.

10-35. CODE X2 is applied to items which are not purchased for stock but may be acquired for use through salvage or one-time purchase. Activities requiring such items will attempt to obtain them from salvage; if not obtainable from salvage, or readily manufactured, such items shall be requisitioned through normal supply channels with supporting justification. Repeated requisitions shall justify a change to the "P" series.

10-36. U SERIES.

10-37. CODE U is applied when not of supply or maintenance stocking significance.

10-38. RECOVERABILITY CODE DEFINITIONS.

10-39. Recoverability codes are codes which reflect the recoverability characteristics of items removed from equipment at time of maintenance, repair or overhaul; i.e., repairable, salvageable, or consumable.

10-40. CODE R: REPAIRABLE.

10-41. CODE R shall be applied to items which are economical and practical to repair on a programmed basis through a major rework activity. Replacements are obtained from the supply system on an exchange basis, if and when possible; i.e., an item may be lost or damaged beyond recognition.

10-42. CODE D: REPAIRABLE.

10-43. Code D shall be applied to end items of support equipment which are economical and practical to repair on a schedule basis through a major rework activity.

10-44. CODE L: REPAIRABLE LOCALLY (EXCEPT GROUND SUPPORT).

10-45. CODE L shall be applied to repairable items (except end items of support equipment) which are to be repaired locally by using activities or the local fleet support activity within their assigned maintenance responsibility.

10-46. CODE E: REPAIRABLE LOCALLY.

10-47. CODE E shall be applied to end items of support equipment which are to be repaired locally.

10-48. CODE B: CONSUMABLE OR EXPENDABLE.

10-49. CODE B shall be applied to items which are consumable or expendable but require item for item exchange for issue after the initial outfitting.

10-50. CODE C: CONSUMABLE.

10-51. CODE C shall be applied to items consumed or expended in use and do not require an item for item exchange.

10-52. VENDORS CODE.

10-53. Parts purchased from other manufacturers and used without alteration are listed in the Group Assembly Parts List under the part number of the original manufacturer. The name of the original manufacturer is indicated by a numerical code symbol following the description of the part. These code symbols are the Federal Identification Numbers listed in Federal Cataloging Handbook H 4-1. The code symbols used in the Group Assembly Parts List are arranged numerically in the following list. When no code symbol exists for the manufacturer, the manufacturer's full name and address will be included in the Group Assembly Parts List.

VENDORS' CODE

CODE	VENDOR
05574	Viking Industries 21343 Roseco Blvd. Canoga Park, Calif.
10001	Bureau of Naval Weapons
12357	Brundy Corp., Omaton Div. Norwalk, Conn.
71468	Cannon Electric Co. 3208 Humboldt St. Los Angeles 31, Calif.
77820	Scintilla Division Bendix Corp. Sidney, N. Y.
82050	Babcock Electronics Corp 1640 Monrovia Ave. Costa Mesa, Calif.
97539	Automatic & Precision Manufacturing Co. Englewood, N.J.

SECTION XI

GROUP ASSEMBLY PARTS LIST

Figure 11-1. Radio Receiving Set, AN/DRW-29, Part No. 2192951

FIG. & INDEX NO.	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
1	2192951	RECEIVING SET, RADIO, AN/DRW-29 (10001) .	1	
	111894	RECEIVING SET, RADIO, AN/DRW-29 (82050) .	Ref	
-1	2192952	. RECEIVER, RADIO, R-1136/DRW-29 . . . . (10001) (For details see Fig. 2)	1	
	112000	. RECEIVER, RADIO, R-1136/DRW-29 . . . . (82050)	Ref	
-2	2192953	. BASE, MOUNTING (10001).	1	
	21928	. BASE, MOUNTING (82050).	Ref	

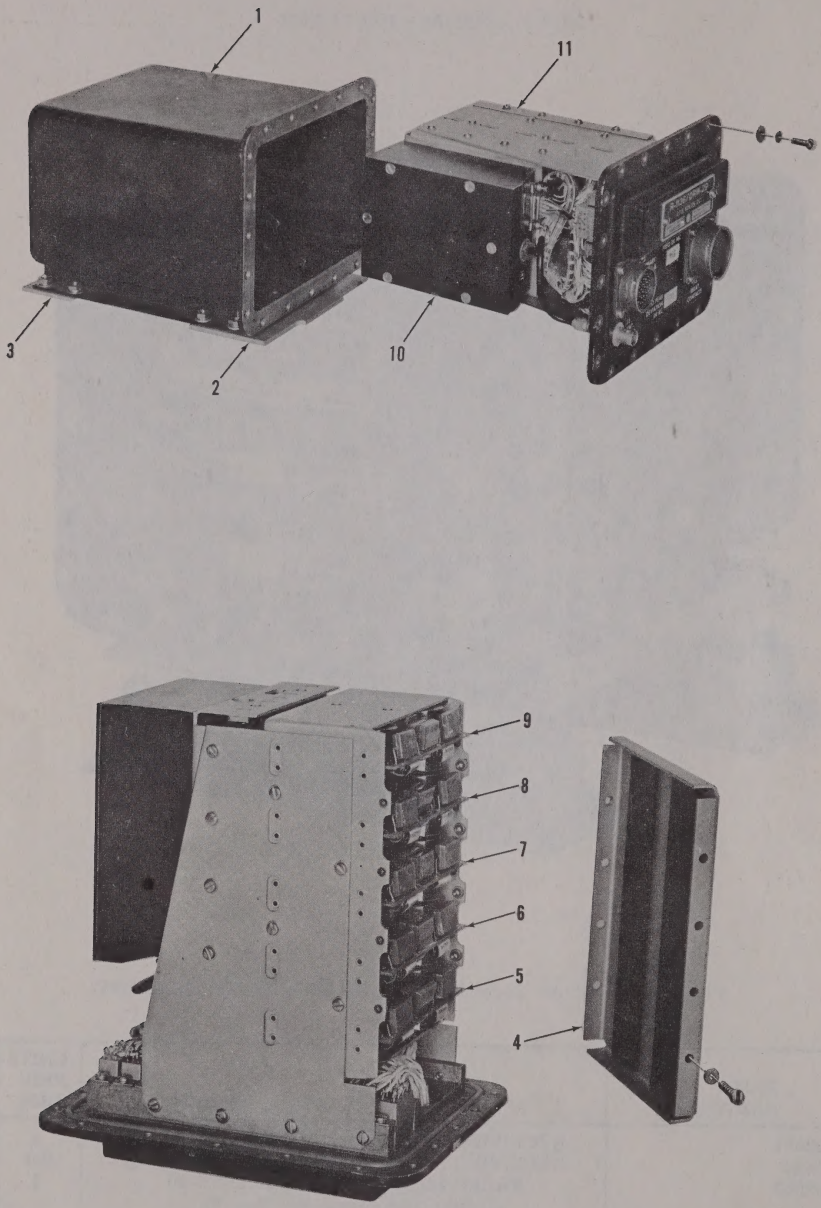

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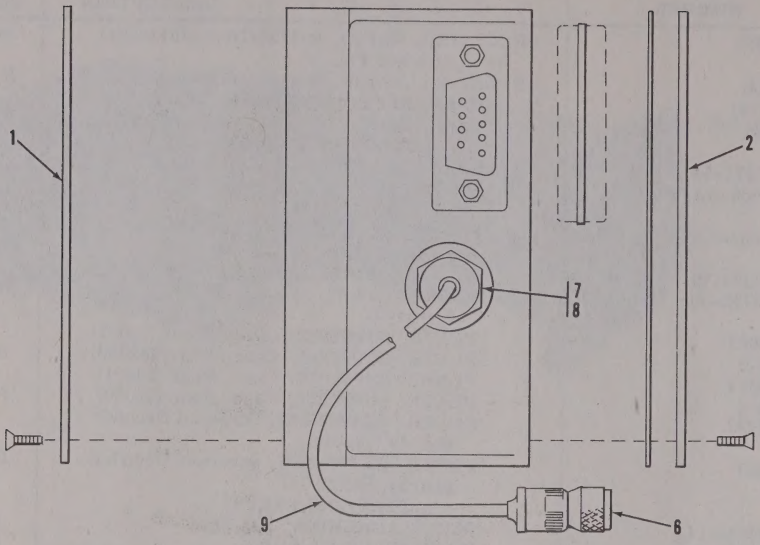
Figure 11-2. Radio Receiver, R-1136/DRW-29, Part No. 2192952

FIG. & INDEX NO.	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
2	2192952	RECEIVER, RADIO, R-1136/DRW-29 (10001) . . (For NHA see Fig. 1)	Ref	
	112000	RECEIVER, RADIO, R-1136/DRW-29 (82050) . .	Ref	
-1	2193000	. CASE, RECEIVING SET, RADIO (10001) . .	1	
	112821	. CASE, RECEIVING SET, RADIO (82050) . . (ATTACHING PARTS)	Ref	
	MS35275-31	. SCREW, MACHINE, Fillister Head	20	
	SS-0832-AA-8	. SCREW, SEAL (97539) (10001 Spec . . . . . cont dwg 2193137)	4	
	SS-0832-AA-8	. SCREW, SEAL (27539) (82050 Spec . . . . . cont dwg 12370-3-8)	Ref	
	MS35338-79	. WASHER, LOCK, Split	20	
	MS15795-305	. WASHER, FLAT . . . . . ---*---	20	
-2	2192968	. PLATE, SUPPORT, Case, Front (10001) . .	1	
	9635-3	. PLATE, SUPPORT, Case, Front (82050) . .	Ref	
-3	2192967	. PLATE, SUPPORT, Case, Rear (10001) . .	1	
	9635-2	. PLATE, SUPPORT, Case, Rear (82050) . .	Ref	
-4	2192997	. COVER, RETAINING, Screened Decoder . . Boards (10001)	1	
	112048	. COVER, RETAINING, Screened Decoder . . Boards (82050) (ATTACHING PARTS)	Ref	
	MS35233-14	. SCREW, MACHINE, Pan Head	12	
	MS15795-303	. WASHER, LOCK, Split . . . . . ---*---	12	
-5	2193025-1	. DECODER SUBASSY, SIGNALS, Command . (10001)	1	
	22217-1	. DECODER SUBASSY, SIGNALS, Command . (82050)	Ref	
-6	2193025-2	. DECODER SUBASSY, SIGNALS, Command . (10001)	1	
	22217-2	. DECODER SUBASSY, SIGNALS, Command . (82050)	Ref	
-7	2193025-3	. DECODER SUBASSY, SIGNALS, Command . (10001)	1	
	22217-3	. DECODER SUBASSY, SIGNALS, Command . (82050)	Ref	
-8	2193025-4	. DECODER SUBASSY, SIGNALS, Command . (10001)	1	
	22217-4	. DECODER SUBASSY, SIGNALS, Command . (82050)	Ref	
-9	2193025-5	. DECODER SUBASSY, SIGNALS, Command . (10001)	1	
	22217-5	. DECODER SUBASSY, SIGNALS, Command . (82050)	Ref	
-10	2193093	. UNIT, RECEIVING (10001) (For details . . . see Fig. 3)	1	
	111691	. UNIT, RECEIVING (82050). . . . . (ATTACHING PARTS)	Ref	
	AN507C632-36	. SCREW, MACHINE, Flat Head . . . . . ---*---	4	
-11	2193106	. RECEIVER SUBASSY (10001) (For details . see Fig. 4)	1	
	112155	. RECEIVER SUBASSY (82050)	Ref	



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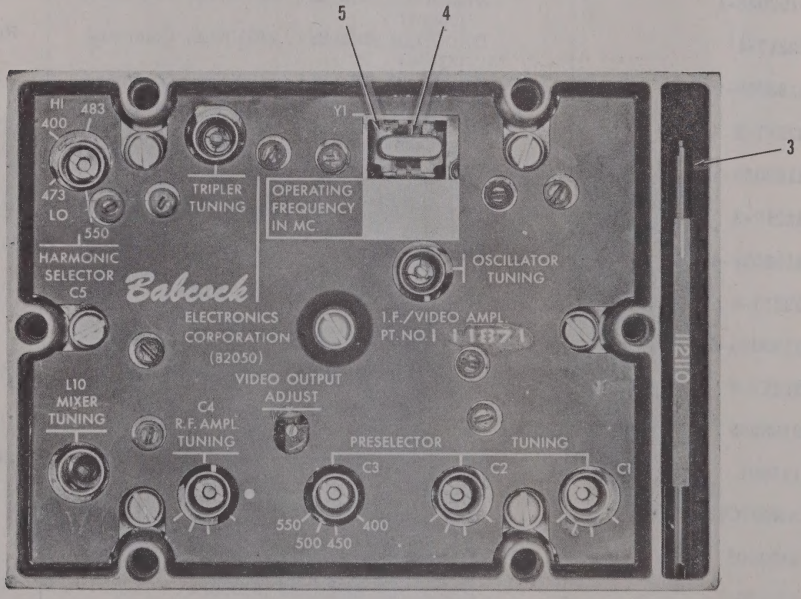

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Figure 11-3. Receiving Unit, Part No. 2193093

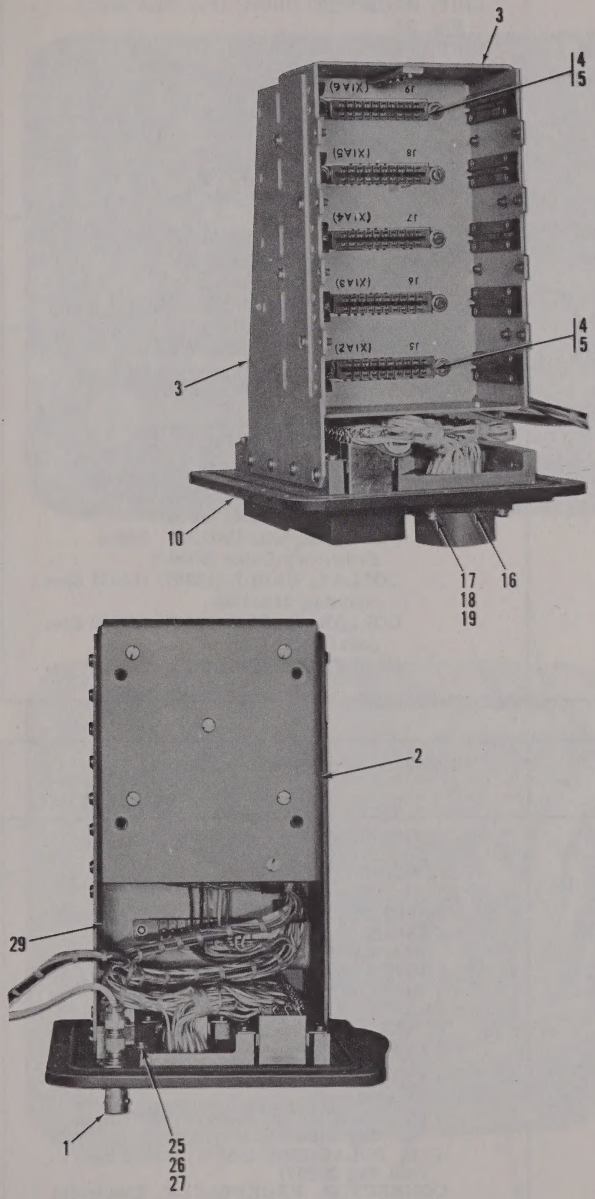

Figure 11-4. Receiver Subassembly, Part No. 2193106

FIG. & INDEX NO.	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
3	2193093	UNIT, RECEIVING (10001) (For NHA see Fig. 2)	Ref	
	111691	UNIT, RECEIVING (82050)	Ref	
		PARTIAL BREAKDOWN FOLLOWS		
-1	2193008	. COVER, TOP (10001)	1	
	111870-2	. COVER, TOP (82050)	Ref	
-2	2193007	. COVER, BOTTOM (10001)	1	
	111870-1	. COVER, BOTTOM (82050)	Ref	
		(ATTACHING PARTS)		
	AN507C632-12	. SCREW, MACHINE, Flat Head	4	
		---*---		
-3	2192996	. TOOL, ALIGNMENT (10001)	1	
	112110	. TOOL, ALIGNMENT (82050)	Ref	
-4	CR77/U	. CRYSTAL	1	
-5	2193089	. AMPLIFIER, INTERMEDIATE FREQUENCY (10001)	1	
	111871	. AMPLIFIER, INTERMEDIATE FREQUENCY (82050)	Ref	
	2193082	. CABLE ASSY, RADIO FREQUENCY (10001)	1	
	112911	. CABLE ASSY, RADIO FREQUENCY (82050)	Ref	
-6	UG693/U	. . CONNECTOR, PLUG, Electrical	1	
-7	2193095	. . FERRULE, GROUNDING, Radio Frequency Cable (10001)	1	
	112625	. . FERRULE, GROUNDING, Radio Frequency Cable (82050)	Ref	
-8	Y1C 194	. . COLLAR, CABLE (12357) (10001 Spec cont dwg 2193136)	1	
	Y1C 194	. . COLLAR, CABLE (12357) (82050 Spec cont dwg 12544)	Ref	
-9	RG122/U	. . CABLE, COAXIAL	1	

FIG. & INDEX NO.	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
4	2193106	RECEIVER SUBASSY (10001) (For NHA see Fig. 2)	Ref	
	112155	RECEIVER SUBASSY (82050)	Ref	
		PARTIAL BREAKDOWN FOLLOWS		
-1	UG691/U	. CONNECTOR, RECEPTACLE, Electrical	1	
-2	2192978	. CHASSIS, ELECTRICAL EQUIPMENT, Receiver Mounting (10001)	1	
	112070	. CHASSIS, ELECTRICAL EQUIPMENT, Receiver Mounting (82050)	Ref	
-3	2192990	. PLATE, PANEL, Mounting (10001)	2	
	112635	. PLATE, PANEL, Mounting (82050)	Ref	
		(ATTACHING PARTS)		
	MS35233-14	. SCREW, MACHINE, Pan Head	8	
	MS15795-303	. WASHER, FLAT	8	
		---*---		
-4	091-0024-000	. TAB, POLARIZING (05574) (10001 Spec cont dwg 2193115)	10	
	091-0024-000	. TAB, POLARIZING (05574) (82050 Spec cont dwg 22207)	Ref	
-5	2VH10/1AB3	. CONNECTOR, RECEPTACLE, Electrical (05574) (10001 Spec cont dwg 2193114)	5	
	2VH10/1AB3	. CONNECTOR, RECEPTACLE, Electrical (05574) (82050 Spec cont dwg 22203)	Ref	
-6	2193104	. PANEL SUBASSY, FRONT (10001 (For details see Fig. 5)	1	
	112121	. PANEL SUBASSY, FRONT (82050)	Ref	

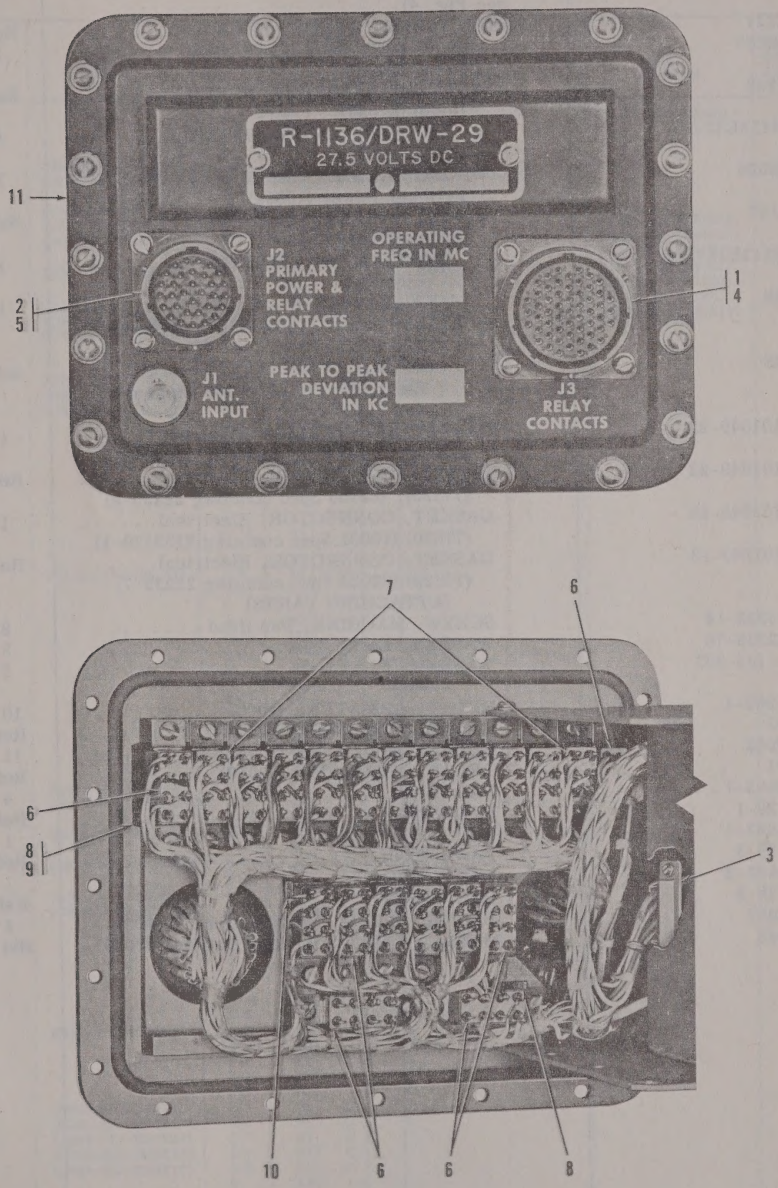

Figure 11-5. Front Panel Subassembly, Part No. 2193104

FIG. & INDEX NO.	PART NUMBER	1 2 3 4 5 6 7 DESCRIPTION	UNITS PER ASSY	USABLE ON CODE
5	2193104	PANEL SUBASSY, FRONT (10001) (For NHA . . see Fig. 4)	Ref	
	112121	PANEL SUBASSY, FRONT (82050)	Ref	
	2193085	. WIRING HARNESS, BRANCHED, ... Relay (10001)	1	
	112148	. WIRING HARNESS, BRANCHED, ... Relay (82050)	Ref	
-1	MS3112E22-55S	. . CONNECTOR, RECEPTACLE, ... Electrical	1	
	2193086	. WIRING HARNESS, BRANCHED, ... Primary Power (10001)	1	
	112147	. WIRING HARNESS, BRANCHED, ... Primary Power (82050)	Ref	
-2	MS3112E18-32P	. . CONNECTOR, RECEPTACLE, ... Electrical	1	
-3	DE9S	. . CONNECTOR, PLUG, ... Electrical (71468) (10001 Spec cont dwg 2193117)	1	
	DE9S	. . CONNECTOR, PLUG, ... Electrical (71468) (82050 Spec cont dwg 22303)	Ref	
-4	10-101949-22	. GASKET, CONNECTOR, Electrical. . . . . (77820) (10001 Spec cont dwg 2193129-2)	1	
	10-101949-22	. GASKET, CONNECTOR, Electrical. . . . . (77820), (82050 Spec cont dwg 22235-9)	Ref	
-5	10-101949-18	. GASKET, CONNECTOR, Electrical. . . . . (77820) (10001 Spec cont dwg 2193129-1)	1	
	10-101949-18	. GASKET, CONNECTOR, Electrical. . . . . (77820) (82050 Spec cont dwg 22235-7) (ATTACHING PARTS)	Ref	
	MS35233-14	. SCREW, MACHINE, Pan Head	8	
	MS35338-78	. WASHER, Lock, Split	8	
	MS15795-303	. WASHER, FLAT	8	
		---*---		
-6	2192962-1	. RELAY, ARMATURE (10001)	10	
	22202	. RELAY, ARMATURE (82050)	Ref	
-7	2192963	. RELAY, ARMATURE (10001)	11	
	22201	. RELAY, ARMATURE (82050)	Ref	
-8	2192993-1	. PAD (10001)	4	
	112129-1	. PAD (82050)	Ref	
-9	2192993-3	. PAD (10001)	1	
	112129-3	. PAD (82050)	Ref	
-10	2192993-2	. PAD (10001)	1	
	112129-2	. PAD (82050)	Ref	
-11	2192957	. PANEL, FRONT, Marking Details (10001)	1	
	112045	. PANEL, FRONT, Marking Details (82050)	Ref	

SECTION XII

NUMERICAL INDEX

PART NUMBER	STOCK NUMBER	FIG. & INDEX NO.	SOURCE CODE	ACCT/ RECOVER CODE
AN507C632-36		2-	N	
AN632C632-12		3-	N	
CR77/U		3-4	U	
DE9S	R5935-583-5501FCRC	5-3	P1	C
MS15795-303	G5310-595-6211	2-	P1	C
MS15795-305		2-	N	
MS3112E18-32P	R5935-809-8808B210	5-2	P1	C
MS3112E22-55S	N5935-825-8520	5-1	P1	C
MS35233-14	G5305-579-3027	2-	P1	C
MS35275-31		2-		
MS35338-78	R5310-042-9609G192	5-	P1	C
MS35338-79		2-	N	
RG122/U		3-9	P1	C
SS0832AA8	R5305-863-1845E323	2-	P1	C
UG693/U	N5935-549-6085	3-6	P1	C
Y1C 194		3-8	N	
091-0024-000		4-4	N	
10-101949-18	R5330-807-4773E111	5-5	P1	C
10-101949-22	R4920-822-7928S110	5-4	P1	C
111691	R5895-971-9025E121	2-10	P1	L
		3-		
111870-1		3-2	MF	
111870-2		3-1	MF	
111871		3-5	X1	
111894		1-	AF	
112000		1-1	P1	L
		2-		
112045		5-11	X1	
112048		2-4	MF	
112070		4-2	X1	
112110	R5120-977-3195E111	3-3	P1	C
112121		4-6	X1	
		5-		
112129-1		5-8	MF	
112129-2		5-10	MF	
112129-3		5-9	MF	
112147		5-	AF	
112148		5-	AF	
112155		2-11	X1	
		4-		
112625		3-7	X1	
112635		4-3	MF	
112821		2-1	X1	
112911		3-	AF	
2VH10/1AB3	N5935-985-4909	4-5	P1	C
21928	R5895-446-7875FANN	1-2	P1	C
2192951		1-	AF	
2192952	R5895-059-7516FANN	1-1	P1	L
		2-		
2192953	R5895-446-7875FANN	1-2	P1	C
2192957		5-11	X1	
2192962-1	R5945-061-0810E121	5-6	P1	C
2192963	R5945-080-6957E121	5-7	P1	C
2192967		2-3	MF	
2192968		2-2	MF	
2192978		4-2	X1	
2192990		4-3	MF	
2192993-1		5-8	MF	
2192993-2		5-10	MF	
2192993-3		5-9	MF	
2192996	R5120-977-3195E111	3-3	P1	C
2192997		2-4	MF	
2193000		2-1	X1	
2193007		3-2	MF	
2193008		3-1	MF	
2193025-1	R5895-020-6236E111	2-5	P1	C
2193025-2	R5895-020-6237E111	2-6	P1	C
2193025-3	R5895-020-6238E111	2-7	P1	C
2193025-4	R5895-020-6239E111	2-8	P1	C
2193025-5	R5895-020-6240E111	2-9	P1	C
2193082		3-	AF	
2193085		5-	AF	
2193086		5-	AF	
2193089		3-5	X1	

PART NUMBER	STOCK NUMBER	FIG. & INDEX NO.	SOURCE CODE	ACCT/ RECOVER CODE
2193093	R5895-971-9025E111	2-10	P1	L
		3-		
2193095		3-7	X1	
2193104		4-6	X1	
		5-		
2193106		2-11	X1	
		4-		
22201	R5945-080-6957E121	5-7	P1	C
22202	R5945-061-0810E121	5-6	P1	C
22217-1	R5895-020-6236E111	2-	P1	C
22217-2	R5895-020-6237E111	2-	P1	C
22217-3	R5895-020-6238E111	2-	P1	C
22217-4	R5895-020-6239E111	2-	P1	C
22217-5	R5895-020-6240E111	2-	P1	C
9635-2		2-3	MF	
9635-3		2-2	MF	

SECTION XIII

REFERENCE DESIGNATION

REFERENCE DESIGNATION	FIGURE & INDEX NO.	PART NUMBER
J1	4-1	UG691/U
J2	5-2	MS3112E18-32P
K1 thru K5	5-7	2192963
K11 thru K15	5-7	2192963
K16 thru K20	5-6	2192962-1
K21	5-7	2192963
K6 thru K10	5-6	2192962-1
P1	5-3	DE9S
P3	5-1	MS3112E22-55S
X1A2 thru X1A6	4-5	2VH10/1AB3
1A1	2-10	2193093
1A1A2	3-5	2193089
1A1P1	3-6	UG693/U
1A1Y1	3-4	CR77/U
1A2	2-5	2193025-1
1A3	2-6	2193025-2
1A4	2-7	2193025-3
1A5	2-8	2193025-4
1A6	2-9	2193025-5

REFERENCE DESIGNATION	FIGURE & INDEX NO.	PART NUMBER

SECTION XIV

DIFFERENCE DATA SHEETS

14-1. GENERAL.

14-2. This section shall provide information to accommodate new models of the original equipment by reflecting minor changes from the original design. As of the date of publication, all changes to the equipment have been incorporated in the previous sections. As further changes are made, Difference Data Sheets will be issued to cover model differences.

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